THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW

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THE UNEMPLOYMENT PROBLEM.

FEW things, if any, are so contemptible as the exploitation of the unemployed for political or party purposes. And among the means adopted none are more despicable than the specious arguments used for the purpose of showing that Protection disguised as "Tariff Reform" is the one and only remedy for unemployment. The problem of unemployment is far too serious a matter to be used as the sport of politicians who care not what they kill so long as they help to enlarge the party bag.

According to Sir Gilbert Parker, M.P., the Socialists and the Tariff Reformers are both out to solve the question of unemployment, and at the next General Election the only practical policies put forward will be Socialism and Protection. It is extraordinary that policies so diametrically opposite should produce the same result! "Tariff Reform means work for all," is the lying statement printed day by day by the paper which advocates Sir Gilbert Parker's nostrum.

America is a highly protected country, and is there work for all? According to the last two censuses the results were as follows:—In 1890 the unemployed were 15·1 per cent. of the total wage-earning population; in 1900 the percentage was 22·3 per cent. If we take the actual numbers we find that during the 12 months 3·17 million were unemployed from one to three months, 2·55 million for four to six months, and ·73 million for seven to twelve months; a total of nearly 6½ millions unemployed out of 29 millions. In 1907 we find from the records of the State Department of Labour, that in New York there were 34 per cent. of the wage-earners out of work, 92 per cent. of the idleness being due to *lack of work*. This does not corroborate the claim that Protection means "two jobs for every man."

The American workman who asks for Tariff Reform asks for the removal of protective duties, not for their imposition. But according to the *Times* New York correspondent, "tariff revision is in the hands of the friends of Protection, while the friends of the consuming public are entirely absent from the deliberations." He goes on to say that in the tariff proceedings before the Ways and Means Committee "90 per cent. of the witnesses appear to be beneficiaries."

If we turn to Germany, another very highly protected country, we do not find any grounds in the state of employment to justify the belief that Protection is a remedy for unemployment, or that the workman is better off as a consequence of Protection. If Protection means work for all, how is it that the German Reichstag a few days ago were very seriously discussing the question of unemployment? Speakers showed that at the present time the number of unemployed in Germany may be reckoned at over 800,000 above the normal. In Berlin alone, the number seeking

refuge in the night asylums is 74,000 in excess of the number last year.

We find no sort of satisfaction in these figures, we deplore them. It is of no advantage to us, but distinctly otherwise, that our Continental neighbours and our American kinsmen should be experiencing hard times equally with ourselves. But we call attention to the figures merely to show that neither Free Trade nor Protection affords in itself immunity from bad trade and unemployment, and those politicians who attempt to make party capital out of the misery and distress occasioned by unemployment, are neither patriots nor Imperialists, but enemies of the working classes, and traitors to their country.

The problem of unemployment is one of the most pressing of the social problems which call for solution, and it is one of the most difficult. There is something fundamentally wrong in a system under which men who are in want of the necessaries of life can find no employment by means of which to earn those necessaries. It is one of the penalties of civilisation. In a barbarous or uncivilised community, where every man is his own employer, lack of employment means either that a man has all he needs, or that he does not want to work. The man who needs anything, and is willing and able to work, can work. He need not seek out an employer and beg for work, the work is there, and he may employ himself. One need not elaborate this idea, it is self-evident. The dawn of civilisation ushered in the employer of labour—the slave-owner, and the comparatively recent abolition of slavery, as the result of higher civilisation, has resulted in the present unsatisfactory position described above. The modern employer is under no obligation either to provide work for the workers, or to provide him with food. On the other hand, the worker is under no obligation to work for the benefit of his employer. There is no recognised community of interests between the two; no feeling of co-operation; no working towards a common end. No, it is a question of each, employer and employed, getting the maximum return for the least expenditure.

To a large extent this class antagonism, and all that it has meant in strikes, lock-outs and disagreements, is responsible for the present problem of unemployment. There are no doubt other causes, but this is one of them, and one of the chief.

If we recognise the cause, we have made a step towards a remedy, viz., a frank recognition of the interdependence of the various classes of which human society—and particularly the industrial portion of it—is made up. The reformation of human society is too large an order to undertake all at once, but it may be done by instalments; and there is a hopeful sign in the unmistakable tendency for employers to look upon their workmen as something more than mere hirelings—to recognise that the payment of a minimum standard wage is not the end of their obligation. Nothing short of a complete recognition of this fundamental fact will suffice to stem the tide of that movement, miscalled "Socialism," which aims at State confiscation of all the means of production.

PEAT.

The year is ending well on a sustained peat note, and it is to be hoped that the coming 12 months will not enshroud the body of another still-born scheme for the enrichment of the poorest parts of Ireland by the utilisation of the peat in their bogs on a vastly larger scale than is possible at present.

During the present year an ambitious project knocked at the doors of Parliament, but found great difficulty in getting in, even at the expense of losing its handsomest features. We never looked with favour upon the full proposals of this company, and it is much more likely to make dividends if it sticks for the first few years to the production of by-products—the bull is unintentional—and the generation of electricity for local use, than by making supply in bulk over a large area the main object of its existence. Just at present the public is hearing little or nothing about this peat-power company, but it is understood that the time is not far distant when the public will be asked to subscribe, and until then it is unlikely that much will be known about the exact methods and machinery which will be used to dig the peat from the bog, and to prepare it for the gas producer. Rumour has it, however, that the Ekenberg process finds favour with the promoters and their advisers, and in that connection it is particularly interesting to hear what Mr. Tomlinson has to say in the paper which we abstract in another place, about this process of "boiling the bog," as he calls it.

We would not for the world that the investing public should be choked off peat for another 10 years by the failure of the latest scheme, and we entreat the promoters to make their position and their prospects trebly secure before they begin to spend money on patent rights and plant.

Mr. Tomlinson begins his paper by abjuring certain of his former convictions, which shows him, at least, to be a man of fluid mind, and no little sub-conscious courage.

He finds that the facts of practice are against the possibility of getting peat by machinery at a sufficiently low rate to enable it to compete with coal, and he seeks to adapt to his large scale workings the method of the peasant with his leisure time and crude and immemorial spade, for he finds that hand-got peat even now is the cheapest.

Under present conditions no more than the first few feet of the peat layer are touched, and the supply is not continuous throughout the year.

All the peat that the peasant cuts is saturated with anything up to 90 per cent. by weight of water, which means that he wastes some 80 per cent. of his energy and time if the peat is to be used as 50 per cent. peat in a producer; he wastes a still higher proportion if the peat is to be used for household purposes.

Each sod of saturated turf as it is cut is laid on the bog surface to drain and to dry by evaporation; but Mr. Tomlinson proposes to accomplish the same end by increasing enormously the size of the sod, and by leaving it in the bog, but not of it, until ripe for the gas producer. Narrow trenches are to be dug round cubes of peat, of which the best size will be determined by experiment, and the blocks will stand isolated to dry by the natural agencies of sun, wind and gravitation, aided by artificial drainage.

Probably the trenches would be cut by machine, and the semi-dried mass might be quarried by a mechanical digger, so reducing hand labour to a minimum; but the problem has become very different now to that against which the inventors of mechanical apparatus for getting and treating peat have been knocking their heads, for it is brought down to that of handling a greatly reduced bulk, and one which is actually as ready for use as the coal in an exposed seam.

The idea is magnificent in its bold simplicity, but it is, and must remain, an idea only until the men and the money are found to materialise it. The amount of money required for the preliminary experiments would be small, and Mr. Tomlinson hopes that one of the Irish public departments will come to the assistance of beneficial science, but we would much prefer that private enterprise and patriotism should do the work and bear the risk.

As an engineer with considerable experience in drainage and hydraulics, Mr. Tomlinson is not likely to under-estimate the difficulties which must beset the path of anyone who attempts to drain a bog, but we are disappointed that he has touched so lightly upon what is the vital spot of his proposition. In the conclusion of the paper he says that the production of peat for the generation of power is a subject which is second only to the question of the drainage and reclamation of the bogs. He had intended to include a discussion of the latter subject, but found that the paper was already unduly long.

For our part, we consider that the question of drainage must be treated as an integral part of the scheme, and cannot be relegated to an appendix or postponed to form the subject of another paper.

From conversations with the author, we believe that he is undaunted by the hindrances to drainage, which are, perhaps, more evident from an inspection of the bog itself than from a study of its plans and sections; and that is all the more a reason why he should have taken the minute risk of making the paper tedious, rather than that it should be possible for the most friendly critic to allege that the scheme, as set out, does but stand upon one leg. It is true that most peat schemes have not been furnished with so much as one support, but that does not make a full complement of legs the less necessary to carry the latest to the success which we hope will be its meed.

Turning for a moment to the tables given in Mr. Tomlinson's paper, for which, unfortunately, we cannot spare space, the results are highly interesting, although we do not suggest that they are capable of untempered application to Irish conditions. In the first place, it is shown that commercially dry peat is being sold at a good profit in every case in which the total cost and the selling price are given; secondly, briquetted peat is rarely more valuable than rough peat; thirdly, hand-cut peat costs, as a rule, more than machine-cut peat; and lastly, but most important of all, some of the total costs are so low that they very nearly reduce the cost of fuel at the gas-producer to nothing when the by-products are credited. That is a most encouraging fact, as it indicates that the great shrinkage which the peat would undergo during the period of ripening under Mr. Tomlinson's process must almost certainly accomplish that *desideratum* of free fuel, even without the use of machinery of any kind except for pumping, when that is required.

The promoters of the Irish peat-power scheme would be well advised in their own interests, to say nothing of the coming interests of the shareholder, to ponder well before they commit themselves to the expenditure of huge sums on plant which in the sequel may be unnecessary. Mr. Tomlinson, by a perfectly logical process, hopes to decrease the bulk of the peat by a very considerable quantity before he touches it, and leaves the method of getting the remainder an open question, which is of relatively little importance. If his theory is correct—and it is based on some very comforting facts—we may give the "go-by" to any system which deals with the whole bog mass.

Let us in this matter hasten with extreme slowness, seeing that so wonderful a thing as the better-being of a nation may hang upon success.

Foreign and Colonial Tariffs on Electrical Goods.

For some considerable time we have appreciated the usefulness to manufacturers and merchants in this country of accurate and up-to-date information as to the foreign tariffs on goods which they desire to export. As the electrical industry has advanced and exports have continued to increase, the desirability of placing such information at the disposal of British firms has become more and more apparent to us, and we have therefore decided to begin the work of collecting and publishing reliable information as to the duties charged on electrical and similar goods in all the countries of the world. As will easily be understood, these particulars will be of great magnitude and their publication will extend over a considerable period. Countries will be dealt with alphabetically, the information being given in a form designed as far as possible to admit of facility in consultation, and an instalment will be published each week under the heading, "Foreign and Colonial Tariffs on Electrical Goods" until the whole work is completed. In addition to particulars as to the actual rates of duty, general information of interest to shippers will be given so far as is deemed necessary to enable them to comply with foreign requirements as to shipping formalities. Moreover, any alterations of tariffs which may be made from time to time will be published, and in this way it will be possible to keep the information entirely up to date. The first instalment of this work will be found on p. 991 of the present issue.

In calling attention to this new feature of the Electrical Review, we feel sure that our subscribers will appreciate this further endeavour on our part to assist them in the development of their export trade.

Copper.

There are indications of a vigorous attempt to push the price of copper once more up to the wrong side of £80. We are constantly reminded by writers on financial subjects of the electrification of railroads either under consideration or actually going forward, and of other indications of a heavy consumption of copper in the near future. The Swedish State Railway electrification we know of, Prussian schemes in the same direction are more or less fixed, and we now hear of a similar improvement on a section of the Pennsylvania Railway.

On the other hand, production is in a healthy condition. The output of the Russian Empire has increased some 14 per cent., in spite of a falling-off in the Caucasus. Visible supplies for mid-November are again best on record, at 52,835 tons.

The general tenor of the figures in Messrs. Merton's circular for this period seems to indicate an artificial shortage in consequence of stocks being held for a rise.

The Tramways and Light Railways Association Brakes Committee's Report.

The official circular of this Association for November contains a letter which the chairman wrote to the *Tramway and Railway World*, in exculpation of the attitude which the Brakes Committee of his Association has assumed with regard to the report of the Municipal Tramways Association Committee. Our tramway contemporary took much the same view of the question as we did, and we shall not be surprised to learn that it is as profoundly dissatisfied with the Hon. Arthur Stanley's official declaration as we are ourselves.

The one and only point in favour of the Tramways and Light Railways Association is that they approached the Municipal Tramways Association at the outset of the movement for investigation, with the suggestion that the two associations should co-operate, but their advances were rejected. It is not unnatural, therefore, that there should be a feeling of bitterness in the Tramways and Light Railways Association, which would smoulder until, at the half-past-eleventh hour, as somebody said in Parliament the other day, the Municipal Tramways Association, apparently repenting of their folly, telegraphed from the annual Conference to ask that the publication of the Tramways and Light Railways Association Report might be delayed. This opportunity for mounting the high horse in their turn was not overlooked, and it is probable that without friendly pressure from the Board of Trade, the Tramways and Light Railways Association Committee would not have consented to defer

publication until deputations from both Associations had met Col. Yorke with the idea, as the general public thought, of trying to arrange for the merging of the two reports in one, which should speak for the whole tramway interest.

But the Hon. A. Stanley says that "at this meeting we *again* pointed out that our report was final, but that while we were unable to make any alterations in the report itself, we were, and are still, quite ready to join with the Municipal Association in assisting the Board of Trade to formulate regulations should that department wish us to do so."

It is easily understood how much inconvenience and delay would have been caused by the acquiescence of the Tramways and Light Railways Association in the tardy proposal of the Municipal Tramways Association to amalgamate the labours of both Committees in one report, but that should have been as nothing against the uncertainty, the irritation, and the confusion with which the public would be sure to view two reports, which might disagree perhaps on points of principle, and certainly on points of detail.

How much more dignified it would have been if the Tramways and Light Railways Association Council had said to the Municipal Tramways Association: Well, here is our report printed and ready for distribution, but we will put aside all the angry and bitter feelings which we can be scarcely blamed for cherishing against you, and we will serve the interests which both of our Associations have deeply at heart, and do at the same time the highest service to our country and the highest honour to ourselves by throwing our report with yours into the melting pot; fusing them into an indistinguishable one by the exercise of mutual toleration, compromise and good sense, and re-casting the resulting mixture into a form expressive of the invulnerable strength of unity.

With such a report in hand, how much more easily the Board of Trade officials would be able to prepare regulations which would be accepted by all with the least amount of cavil!

Can anything be weaker than the defence contained in the following sentence from the letter quoted previously? "It appears to the Council that nothing but good can come of the publication of both reports. They are certain to be criticised, and the Board of Trade will, therefore, have the advantage not only of two independent reports from representative bodies, but also of the criticisms which these reports have elicited." Is that the large way in which we expect a really representative body to treat a matter of such importance that nearly two years have been occupied in making investigations?

We are bound to say also, that Mr. J. B. Hamilton in a letter written in the form of a reply to the official explanation of the Tramways and Light Railways Association makes certain statements of fact which are diametrically opposed to some of those made by the Hon. A. Stanley, and brings out other facts of which we were not informed in the latter's letter. It is significant also that Mr. Fell and two other signatories of the Tramways and Light Railways Association report, all of whom are members of the Municipal Tramways Association, have thought it necessary to resign their membership of the Tramways and Light Railways Association.

We cannot find words to express adequately our regret that such an important investigation should be marred, and, we fear, to some extent stultified, by petty factional dissensions; but we have great faith in the good sense of the Board of Trade in this matter, and hope that the publication of the Municipal Tramways Association's report is being delayed in order that it may be brought, as much as possible, into line with the other. That operation must be rendered the more delicate as the alignment has to be produced by the movement of one part only, so that the plane is fixed.

The Mile End Muddle.

Although Mr. Mordey's report on the G.B. system, installed in the Mile End Road, is a semi-confidential document, much of its contents have ere this become public property. The most striking feature of the report is the excellent testimonial to the efficiency of the G.B. system, as installed at Lincoln, which is contained in an appendix compiled by Mr. Mordey himself; and his conclusion that if the Lincoln line could be placed in the Mile End Road, it could be made to run satisfactorily by attention to simple details, is additionally interesting, although this conclusion is apart from the question of live studs.

Now the question of stud design occupies the major part of the report, as might be expected from the foregoing, and Mr. Mordey as a result of his investigations, with a view to increasing the sensitiveness of studs and preventing the possibility of arcing between the contact-piece and cable, recommends the use of studs modified to his design, on a half-mile section, that one or two cars should be fitted with extra trailing brushes, connected to the skate alternatively through a resistance shunt and a condenser, and that these cars should be run over the modified track. He also suggests a trial of the collector with two exciting coils only.

We cannot, of course, pretend to Mr. Mordey's intuition regarding the peculiarities of the G.B. stud, and therefore merely remark in passing that, as modified, it appears to possess certain radical defects, and to be in no way superior to the stud adopted successfully at Lincoln by the licensors, on the strength of their six or seven years' experience.

But while the studs come in for criticism, strangely enough we find but scant reference in the report to the collecting equipments. This is somewhat remarkable, in view of the fact that the cars for this service have never been provided with G.B. collecting equipments, and that the equipments which have been used, and proved such dismal failures, were designed solely by the Council's staff.

One feels tempted to ask why the admittedly faulty equipments should be whitewashed at the expense of the studs, which have proved their quality at Lincoln? For, allowing for the mysterious properties of the Mile End mud, one cannot reconcile the extraordinary behaviour of the Aldgate-Bow track with that of the Lincoln tramways.

Another paragraph in the report, which throws considerable light on the relations existing between the Council and the licensors, is that in which Mr. Mordey refers to his inability to obtain from the licensors a statement of the defects to which they attribute the faulty working of the line. That such a statement could not be supplied must have been perfectly well known to the Council, who have consistently withheld from the licensors all essential technical information as to the progress of the work, which, it must be remembered, was carried out by the Council themselves.

Indeed, the atmosphere of ignorance appears to have been general; the Council, knowing nothing of the small details which make for success in the G.B. system, proceed to install it; the licensors, with every detail at their fingers' ends, are yet in ignorance of the elementary facts as to the progress of their system: Mr. Mordey, on his own showing, is in ignorance of the licensors' views of the matter and evidently unaware of their inability to supply him with essential information. So much for the report, the recommendations of which it is intended shall be carried out at the expense of the licensors, whose interests one would have thought had been sufficiently jeopardised by the unforeseen treatment meted out to them.

But will the licensors agree to pay for what they may rightly consider to be unjustifiable modifications to their designs? We doubt it; the G.B. Co. have already expressed their willingness to put into practical operation a half-mile section of the Mile End track, free of expense to the Council, and if the Council see fit to ignore such a favourable offer—both from their own and the ratepayers' point of view—there can be no earthly reason why the licensors should sacrifice their already damaged interests, by paying for modifications with which they may not agree, and which would not have been called for but for the extraordinary bungling of the Council.

Whatever may be the Council's predilections in the matter, justice demands that the G.B. Co. shall have a reasonable opportunity of rehabilitating their system.

A TRAVELLING STUDENTSHIP.

By R. BORLASE MATTHEWS, Wh. Ex., A.M.I.C.E.

A VOLUME containing the *Proceedings* of the Incorporated Municipal Electrical Association has recently been issued to the members, and among the more interesting features of the publication there is a report by the holder of an Associate's "travelling studentship." It is an excellent example of the progressive side of the Association, this offering of a prize in order to encourage the junior members to visit other undertakings with the definite object of ascertaining how work is carried out in other places. There is no doubt that the very fact that the duties of a central station manager do not necessitate his travelling much is in itself a drawback, as there is no better way of widening experience than by taking full advantage of seeing what others in the same line of work are doing. Hence much good must be done by getting those who will probably become managers and engineers in the future, to see as much as they can before their responsibilities become too great.

The report which was sent in is, in itself, a proof of the need of a wider experience, since the conclusions arrived at are narrowed by want of knowledge of what stations other than those visited are doing. To take an example, the holder of the studentship, when referring to publicity methods, makes a statement to the effect that he gathered from his reading of articles in the technical Press that central station engineers were giving more attention to these matters than he found was the case at the particular undertakings he visited. He has evidently taken it for granted that those places must necessarily be typical of all the rest. When he has had the opportunity of visiting a greater number of central stations, possibly he will change his views somewhat. Quite properly he condemns the "shrieking American business tactics" he has seen described in the Press, which, of course, are useless for application in this country with its conservative people and restrictive legislation. It must not be overlooked, however, that there are sound business principles behind these tactics, which apply equally well here, though the mode of presentation to the public must be different. These principles are somewhat new as applied to British central station practice, but they are no novelty to the business warehouses of London, Manchester and other places. Though American new business-getting tactics may seem to be extreme they are very effective in the land of their origin, and their very description affords the thinking central station manager an opportunity for thrashing out the underlying principles, and then making his own adaptations that will suit the inhabitants of his supply area.

A supply of suitable pamphlets collected together in a showroom seems to be the best means of advertising, according to this report. This, however, is the main fault of the practice of many central stations, that the advertising literature never gets any further than into the hands of the particular few who visit the office or showroom of the undertaking. Many now realise this, with the result that at present there are over 120 central stations regularly distributing advertising matter either by post or by delivery from house to house.

The reporter concludes his remarks on publicity methods with some observations to the effect that he had ascertained that there is nothing better for the successful operation of an undertaking than *esprit de corps* founded on a bonus system. It is not usual to associate *esprit de corps* so closely with financial considerations, but there is no doubt that the idea to which he has referred, is a very sound one in practice. It is certainly to the best interests of all on the staff of a central station, that each individual should do his best to make existing consumers satisfied, and exercise his influence among those non-users of electricity with whom he comes in contact, in order to get them to become consumers.

The report is open to criticism from the point of view that the amount of travelling done was insufficient to gain a wide enough experience to ensure the accuracy of all the conclusions reached, but, nevertheless, the report in itself is an excellent one, and the author and holder of the travelling studentship, Mr. Robert McCourt, is to be congratulated on avoiding the "dry-as-dust" method of describing a visit to a series of stations. His manner of striking out in an original and very readable way makes the matter of more general interest than a description of the catalogue order, however accurate, would be. For, after all, the value of a comparison of methods of central station operation is to be found in the principles underlying the reasons for the adoption of certain apparatus or schemes, not in the actual apparatus and schemes themselves, except in so far as they are adapted to attain the end desired.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Direct Supply.

I have, as a contractor, read with much interest your letter from the Windsor and District Electrical Co., entitled "Direct Supply," and I think that it calls attention to a state of affairs which requires remedying without delay.

At the same time, however, I do not think it fair that the wholesale houses should be blamed for this, as the following two reasons will show that the electrical contractors have only themselves to thank for the position they now find themselves in, and that the general public think they are entitled to a trade discount, which is the legitimate profit of the contractor :—

1. In their eagerness to secure installation business, contractors, in order to cut out their competitors, constantly offer to divide the "trade" discount with their client. It is owing to this fact that many private individuals with whom I have had business transactions feel that they are fully entitled to the whole of the allowance off the wholesale lists, and when told differently, take their business elsewhere.

2. It is now a frequent practice of many of the large stores to allow their clients a fairly liberal discount off any electric light fittings purchased, which they can fully afford to do when carrying out furnishing schemes, &c., but without any thought for the smaller contractor, who cannot fall back upon other lines for his profit.

The above two instances clearly show how the term, "trade discount," is a misnomer, but at the same time I quite fail to see why, because the trade are justly allowed a discount, there is any reason why it should be handed to the public generally.

Furthermore, I have recently seen that certain manufacturers of proprietary articles, such as tantalum and Osram lamps, have done their utmost to maintain the price of these to the consumer, but I am afraid they have not in every instance met with the assistance from the contractors that their efforts deserve.

The Electrical Contractors' Association has a very large membership, and much influence. Let it, therefore, pass a stringent rule whereby all its members agree that under no circumstances will they pass their trade discount on to any private individual, and if this rule is strictly adhered to (surely the contractor would be only too pleased to do this), then it will go a very great way to removing the present existing system, which is not only highly unsatisfactory to the contractor, but must also be so to the wholesale houses.

Apologising for having trespassed to such an extent on your valuable space, which trespass can only be justified by the importance of the principle involved.

A Contractor.

I have read with interest the letter on "Direct Supply," published in the ELECTRICAL REVIEW of the 20th inst. from Mr. T. Bridgen, manager of the Windsor and District Electrical Co., and will you kindly permit to say through the columns of your valuable paper, that I have received letters from customers who informed me that they could procure goods from ..... & Co. at 15 per cent. cheaper than my estimates, which have been given at list prices.

I recently had an order, "Please supply ..... lamps as list ....." and a few days afterwards received a letter

D

reading : "Can procure ..... lamps at 25 per cent. less than list price, if you cannot do them the same, cancel order." Another instance is where I am asked to quote for a certain make of switchgear, and after estimating for same, I am informed that Messrs. ..... & Co. who are not directly in the trade, can procure the very same switchgear exactly at the same price as I can.

It is time this kind of dealing was extinct, and I would like to call the attention of all interested to an advertisement issued by the Sunbeam Lamp Co., Ltd., and published in the ELECTRICAL REVIEW of November 20th : "Sunbeam Metal Lamps, Protection of Trade Interests."

If all electrical manufacturers would carry this out very stringently, and not supply others than those actually in the trade, and again, only supply to the trade at one price, and have a signed agreement that the lamps or other electrical manufactures should not be resold at a less price than that fixed by the company, it would make things much better for all concerned.

I would like to see this system with every kind of electrical manufactures.

W. J. Cox.

Netherton, Dudley, *November 23rd*, 1908.

Electrical Driving in Cotton Mills.

There is much in Mr. W. H. Booth's article which is open to criticism, and many points to which exception might be taken, but I desire only to make some remarks regarding the figures given in the tables in your issue of November 20th.

I think the sum of £600 allowed for the engine house (Est. No. 1) is very low and out of all proportion to the figure of £400 in estimate No. 2 for the turbine house, seeing that the floor area of the latter would only be about 25 per cent. of the former, presuming that, as is probable, a horizontal engine is contemplated. Furthermore, the room would not need to be nearly so lofty. However, I accept the estimates for the capital and running costs for the mechanical rope drive as given, *i.e.*, £18,435, and £5,559 per annum respectively.

In estimate No. 2 the price for the turbo set and condenser is given at £6,600. As I write I have before me an estimate from one of the leading makers of such a plant, including motor-driven condenser pumps, the price being £4,500, delivered and erected ; the condenser to give 28 in. vacuum (barometer 30 in.) with cooling water at 75° F. The steam consumption of the set with this vacuum, 160 lb. steam pressure and 100° F. superheat, to be 17¼ lb. per KW.-hour at the generator terminals.

Assuming that the steam consumption of the engine in estimate No. 1 is 11 lb. per I.H.P.-hour, we find that allowing a mechanical efficiency of 88 per cent. this is increased to 12½ lb. per B.H.P.-hour, or 16·8 lb. per 1½ B.H.P.-hour, equivalent to 1 KW.-hour at the generator terminals in estimate No. 2 ; thus the steam consumption of the turbo set is only 2·7 per cent. greater than that of the reciprocator instead of 11·7 per cent., as indicated in the article by the figures for the coal bill.

Under these circumstances, the capital cost of the boilers, &c., should be made the same in each case—*i.e.*, £2,400, and the weight and value of the coal in estimate No. 2 reduced to 3,954 tons and £2,471 respectively.

Four thousand pounds is allowed in estimate No. 2 for cables, switchboard and motors. This, again, is too high unless individual driving is in part allowed, for, which system is not generally adopted. I have made inquiries, and find that the actual cost of the item mentioned in the case of a new mill in Lancashire of the same size which is electrically driven, was £3,400. Estimate No. 2 should, therefore, be further amended accordingly.

As regards lighting, this can be and is generally carried out from the same three-phase generator as is supplying power, with entirely satisfactory results. Consequently, the additional £560 allowed in the estimate should be removed. In this connection it is interesting to note that the estimates given in the article allow £1,710 for the lighting in the case of the electrically-driven mill, and only £1,450 for the rope-driven installation, although the lighting plant and number of lamps are the same for both cases.

Now, taking into account the reductions in estimate No. 2 referred to above, all of which I know to be fair and not cut figures in any way, we find the total capital cost of the electrical installation on the basis given to be £18,430, or practically the same as for the mechanical rope drive ; but it will be appreciated that for the value of the land and space occupied by the larger engine room and the rope race (the latter often reducing the room which might otherwise be useful for productive work by some 5 per cent.), the balance is decidedly in favour of the electric drive from the capital cost point of view.

From the above figures the running costs for the electrically-driven mill will be seen to be :—

Coal, 3,954 tons, at 12s. 6d.	£2,471
Wages as in the article	325
Oil and stores, as in the article	75
Insurance, as in the article	258
Rates, 7s. on 5 per cent. of £18,430	323
Interest and depreciation on £18,430, at 12 per cent	2,212
	£5,664

or equal to 0·486d. per unit.

This slight additional running cost (·007d. per KW.-hour) over the rope drive is surely many times out-balanced by the many advantages gained, notable among which may be mentioned ;—

1. Flexibility in the arrangement of the mill.
2. Flexibility in the running of the mill, especially when short time or partial overtime has to be worked.
3. Improved turning, and consequent improved product and greater output.
4. Elimination of all heavy rope drives which, in the case of a new mill, will allow of reduction in the cost of the mill itself.
5. Less interruption to the light owing to the decreased number of shafts, belts, ropes, &c.
6. Abolition of the rope race, giving greater room for productive work.

And many other minor advantages which it is unnecessary to enter into here. In an old mill these advantages are generally more pronounced than in the case of a new one, while often vertical shafts, bevel gears, and many awkward drives, are eliminated.

Finally, a few words regarding estimate No. 3 (Capital Outlay) :—Motors, cables and switchboards should be reduced to £3,400. Transformers (£1,000) should be eliminated, as these are invariably furnished by the suppliers of the current. Thus the total capital cost should be reduced to £7,680, and the running costs at the price per KW.-hour given, to £7,446. It must be remembered, however, that most supply companies and the larger Corporations will give a far lower figure than ·5625d. per KW.-hour for power loads of 900 KW.

I enclose my card.

G. L.

City and Guilds Honours Examination.

Judging by the report of the Examiners in Electrical Engineering at the recent City Guilds Examination, the new Honours Syllabus cannot be said to have made matters better.

The fact that of those who sat 77 per cent. failed, seems to show that the questions set were not a fair test of their knowledge. To a candidate who must be attending a recognised laboratory and lecture course, the attempting of four questions out of the five set in the second paper does not give much range of choice in showing what he knows of the special branch he is studying. In the first, or general, paper six questions were set, of which five might be attempted ; the range of question extended from the design of a lifting magnet to the torque-speed curves of a three-phase reversing motor ! As these examinations are held for the Advancement of Technical Education, would it not be better to give a larger choice of questions, and so give candidates a better chance ? The evening student needs encouragement, and it seems a pity that only one of the examiners comes in contact with the evening students, who form by far the larger number of the candidates. By-the-by, I notice that in the programme of a well-known London Polytechnic appears the following statement in connection with a course on "Electrical Instruments" :—

"Students who diligently follow these lectures and the connected laboratory work should be well prepared for the Honours Examination in Electrical Instruments of the City and Guilds Institute in Electrical Engineering."

Would that this were so, with so capable a lecturer, but alas! with the present system of setting so few questions it is all a matter of luck.

With reference to the difficulty of obtaining qualified teachers, mentioned in the report, the writer can only add that the qualifications of some of the teachers who are at present recognised are, like Sam Weller's knowledge of London, "extensive and peculiar." It is evidently not an essential qualification to have had practical experience with a commercial firm.

Honours.

A Powerful Station Staff.

"Efficiency" mentions a station staff which may be necessary, but which seems to outsiders rather elaborate. I would point, however, to the Swansea staff. In 1906 this station had a maximum load of only 787 KW., and made a net profit of £349.

This staff, consisting of one chief and 12 assistants, which, moreover, does not include office staff, seems rather elaborate as compared with, say, Partick, which in 1906 had a maximum load of 1,018 KW., and had a staff composed of one chief and five assistants. As I said before, it is not for outsiders to judge of any staff, it depends upon circumstances.

Chief Engineer.

Electric Signalling.

My attention has just been directed to the article in your issue of the 13th inst. on the subject of Capt. Gardiner's proposed system of cab signal and electrical control of running trains. Capt. Gardiner is at present *en route* to India; it will be some time, therefore, before he can reply to your remarks, and as it is undesirable that your article should be considered as, by any means, the last word on the subject of cab signals and electrical control on the lines proposed by Capt. Gardiner, I venture, meanwhile, to crave permission to occupy a portion of your valuable space in replying to your objections to the system of cab signals and electrical train control advocated by Capt. Gardiner, objections which are raised mainly on general, rather than technical, grounds.

Your article characterises Capt. Gardiner's proposals as "impracticable," and the main grounds for this sweeping condemnation appear to be that you assume that Capt. Gardiner proposes to dispense altogether with signalmen and all the apparatus they operate or control.

Starting from this assumption, it is argued that junction working cannot be dealt with without human judgment; that an automatic system cannot select, cannot re-arrange traffic or perform the simplest shunting operations or deviations from the organised service, &c. Capt. Gardiner is an officer of some considerable railway experience, and he might surely be given credit for the knowledge of the fact that an automatic machine simply performs the work human intelligence has set it to do, and that where variations from the work it is set to perform are required from it, human directing power must come in.

No such foolish claim is made for the suggested new system of train signalling and control as that it dispenses with the human brain. Brain control of the intricate problems of railway train working is, of course, essential, and no railway official of experience would propose to tie down the varying operations of shunting, &c., to the entire automatic control of any machinery, whether on Capt. Gardiner's or any other system.

Capt. Gardiner's so-called "dictum" that "with automatic signalling *as far as indicating the condition of the track is concerned*, manual control is not only superfluous, but undesirable," has, I think, been misunderstood from failing to attach proper weight to the words in the portion which I have underlined.

All I understand Capt. Gardiner's dictum to mean is, that manual control of the mechanism by which the track itself is made to indicate its condition (clear or blocked), is not only superfluous, but undesirable, and this I venture to think is an "axiom," not a "dictum," and is a very different thing from claiming that brain control is not required at junctions, stations, &c.

The working of Capt. Gardiner's model of a station yard, exhibited brain control to the fullest extent, and indicated how the brain control at the station conveyed its orders or instructions to the driver. It being impracticable to place humans on the little model engines, or in the station yard, has apparently misled people into thinking that the human element was being eliminated altogether, although in demonstrating the working of the model Capt. Gardiner over and over again explained that this was not thought of. The essence of the new system of working may, I think, be said to be not to remove human control, but to ensure, as far as humanly practicable, that the instructions conveyed to the drivers shall not be overlooked through inadvertence or any other cause. There is no desire to interfere with the responsibility of the human in charge of the machine, he will be as responsible as ever, but he is being safeguarded to a very important extent, against any inadvertence possibly leading to most disastrous results. The humans to whom are entrusted the anxious and arduous duties of running our trains and controlling their movements will, I believe, welcome such alleviation of their trying task.

The next serious objection raised to Capt. Gardiner's proposed cab signal as a substitute for an outside semaphore, is that it has "the inherent and ineradicable defect that its failure will retard the train throughout its whole journey." In the case of a cab signal going out of order, which is presumably the contingency in question, the one engine and the one train is inconvenienced until the apparatus on that engine is repaired or replaced. In the case of a defective outside signal applicable to all trains, every train is inconvenienced over the local section which that signal controls until it is repaired or replaced. The question is, which of these objections is the greatest? When cab signals become an every day item of railway equipment, they will be standardised and so perfect, that their liability to go out of order will be minimised, and will, it is hoped, be almost negligible. Spare apparatus would, moreover, be kept on the cab or in the brake vans or at stations as was found most suitable, and drivers would readily learn the art of exchanging them when necessary, in a very few minutes. Electrical working has a tendency to alarm people to begin with, but electrical machinery and apparatus of all kinds is becoming so common nowadays that it is ceasing to be the "bogey" it was.

The next objection raised is that if the new system were adopted old plant would have to be "scrapped." I am afraid this is too true. Old men and old machines have to be "scrapped" daily. It is the price we have to pay for living in a progressive age—no new idea can be taken up without involving something in the form of "scrapping," and so far as this is concerned the present proposal is no worse than any other improvement; visit any railway in the world that keeps itself even moderately up-to-date, and this operation of "scrapping" will be found to be going on all round. It is practically unavoidable that it should be so until we reach the "perfect" stage which, I presume, will be in the millennium.

I am afraid I am trespassing too much on your time and space, and I will notice, therefore, only one point further. In the article it is stated that "mechanism of this type is no more infallible than man." Now, this "dictum" seems open to considerable question. The mechanism can go out of order and fail to work, giving in that case a "stop" signal. Man, on the other hand, can go out of order and do very much as he likes. Under such circumstances, his infallibility seems of a lesser order than that of a machine.

Capt. Gardiner's system of cab signals and electrical train control applied to running trains means—first, the substitution of a continuous signal constantly visible indicating the condition of the track (clear or blocked) of the next section ahead in place of an outside signal only temporarily visible on passing fixed points—and, secondly, it compels attention to the signal, which cannot, therefore, be overlooked or disregarded inadvertently.

When the travelling public recognise the additional

safety obtainable from such appliances, train working on some such lines will be introduced, although it involves some "scrapping." The advances that are being made in automatic track circuit working and the experiments already in progress with forms of cab signals and of automatic control indicate pretty clearly that the railway world recognise this fact. Capt. Gardiner does not claim to be the only person who is working at these problems. Finally, it is necessary to get out of one's head that the system proposed means the abolition of all human control or the abandonment of the utilisation of man's reasoning powers. Apologising for the length of this communication,

R. Gardiner, *Lt.-Col. R.E. (Retired).*

London, S.W., *November 25th*, 1908.

APPLICATIONS FOR PARLIAMENTARY POWERS.

Below we give particulars of the applications that have just been lodged by different parties, municipal and company, for powers relating to electric light and power, tramway and railway undertakings :—

(*a*) Electric Light and Power.

Aldershot Gas, Water and District Lighting Co. (electrical supply powers).—Construction or purchase o electricity works in company's area. Supply in bulk outside area. Repeal of powers of Ascot District Gas and Electricity Co. to supply gas in parish of Ash.

Bath Electricity Supply.—Powers to a new company to take over Corporation undertaking, and to make agreements for bulk and tramway supply to Corporation and Bath Electric Tramway Co. Arrangement with Somerset and District Electric Power Co. for exercise of powers.

Biddulph Gas Co.—Permission to apply for powers under the E.L. Acts.

Bradford Corporation (gas, water and electricity).—Bulk electricity supply outside area, and mains extensions for same.

Cardiff Corporation.—Further provisions as to electric lighting undertaking, and as to supply of electricity in bulk.

Chesham Electric Light and Power Co., Ltd.—Extension. Supply powers for Hemel Hempstead, Great Berkhampstead, Berkhampstead and Amersham.

Cleethorpes Urban District Council.—Amendment of 1900 E.L. order, and sundry provisions as to supply.

County of Durham Electric Power Supply Co.—Agreements between this company, the Newcastle-upon-Tyne Electric Supply Co., Cleveland and Durham Electric Power Co., County of Durham Electric Power Distribution Co., Ltd., and Northern Counties Electric Supply Co., Ltd., for connecting up generating stations and works and supply of electricity. Many other provisions.

Herne Bay Urban District Council.—Provisional order for electric lighting.

Hindhead and District E.L. Co., Ltd. (address Tower Road, Hindhead, Surrey).—Extension of area to rural districts of Farnham, Hambledon, Alton, Petersfield, and Midhurst, and other electricity supply provisions.

Holsworthy.—Provisional order applied for by Christy Bros. and Co., Ltd., Chelmsford.

L.C.C. (General Powers).—Utilisation of the premises on the Victoria Embankment now used for a generating station for meter testing and any other purpose in connection with electric supply, or for the accommodation of the Council's staff.

Macclesfield E.L. and Power Co., Ltd., 263, Oxford Road, Manchester, seek a provisional electric lighting order for Macclesfield.

North Metropolitan Electric Power Supply Co.—Extension of powers for supply of energy in Hendon, Finchley, Friern Barnet, Hornsey, Walthamstow, Chingford, and Waltham Cross, and to traction and authorised users; overhead wires; additional capital, &c.

Southampton Corporation.—Extension of supply powers to North and South Stoneham.

Staines.—Prov. order for the Egham Electric Lighting Syndicate.

Stourbridge.—Electric lighting powers are applied for by U.D.C. Revocation of 1899 Order. Annulment of deed of transfer to Shropshire, Worcestershire, &c., Power Co. Power to obtain electricity in bulk.

Turton Urban District Council.—Prov. order for electric lighting.

Wakefield Corporation.—Various small provisions concerning the conduct of the electricity undertaking; also as to the disposal of produce of refuse destructor.

Walton-on-the-Naze.—Electric lighting powers within the Urban District are being applied for by the Coast Development Corporation, Ltd.

Wells Gas Light Co.—The company seeks authority to make application for powers to supply electricity.

West Kent Electric Power Co., Ltd.—Transfer of certain powers of the Kent Electric Power Co., and of powers conferred by the Bromley R.D.C. electric light order of 1903 to the above company. Amendment of 1903 order as to compulsory works and purchase.

York Town and Blackwater Gas Co.—Electricity supply powers are sought from Frimley, Hawley-with-Minley, and Yately, Sandhurst, Crowthorne, Finchampstead and Wokingham Without, Berks. Repeal of Camberley and District E.L. Order of 1906.

(*b*) Electric Tramways.

Anglo-Argentine Tramways Co., Ltd.—Re-organisation, re-arrangement and increase of capital.

Bolton Corporation.—Various powers as to new tramways, &c.

Bradford Corporation.—New tramways; also provisions as to use of tramways for goods and mineral traffic; working motor-omnibuses by electric traction.

Bury Corporation.—Various powers, including compulsory running over tramways of the Heywood and Rochdale Corporations, and various provisions concerning the Corporation electricity works and department.

Dudley Corporation.—Further powers for the granting of leases of tramways and light railways, including the lines acquired or to be acquired from the B.E.T. Co. and four allied companies.

Folkestone, Sandgate and Hythe Tramways Co.—Power to construct and run tramways on the overhead system. Abandonment of part of tramway in 1906 Act. Lift in Sandgate Urban District. Extension of time.

Gateshead and District Tramways Co.—Additional tramways, also power to run trolley cars without rails.

Keighley Corporation.—Various tramway powers, including new lines.

Liverpool Corporation.—Several new tramways in City of Liverpool, and in Huyton-with-Roby Urban District; also powers to run railless system on tramway routes and elsewhere.

London County Council (Tramways and Improvements).—Numerous tramway powers are sought, both for new and reconstruction of existing lines.

London United Tramways, Ltd.—Through routes, bookings, fares and interchange of traffic with other systems; running powers over L.C.C. lines. Various other powers.

Manchester Corporation.—New tramways in Manchester and Levenshulme; running trackless trolley omnibuses; abandonment of certain authorised tramway and extension of time for others.

Northampton Corporation.—Prov. order for tramways extensions.

Oldham Corporation.—Various powers are sought, including new tramways; also supply of electricity to premises outside area of supply, &c.

Oxford and District Tramways.—Recission and variations of 1906 and 1907 agreements between Oxford Corporation and National Electric Construction Co., Ltd. Extension of time. Power to equip tramways on overhead system.

Preston, Chorley and Horwich Tramways Co.—Extension of time. Purchase of tramways from Bolton Corporation. Running powers over Bolton, Wigan and Preston Corporation Tramways. Traffic and working agreements.

Salford Corporation.—New tramways, also use of overhead electric traction for motor-omnibuses. Powers to restrict other persons from supplying electricity in Corporation areas, &c.

Southport and Lytham Tramroad.—Abandonment of undertaking.

Torquay Tramways Co., Ltd.—New tramways in Torquay and Paignton. Powers as to electrical system of operation.

Wallasey U.D.C. (Tramways and Improvements).—A number of new tramway sections are specified for which powers are sought.

Whitworth Urban District Council.—Tramway powers.

(*c*) Railway and Telephone.

Baker Street and Waterloo Railway Co.—Extension of time for works under 1906 Act; Powers to acquire additional lands for extension of station premises; abandonment of certain subways, and other powers.

Central London Railway.—Extension of tunnels and system from Bank to Liverpool Street.

Great Central Railway Co.—Various powers, including altering site (authorised in 1903) for electric generating station of Seaforth and Sefton Junction Railway Co.

North and South Shields Electric Railway.—Revival and extension of purchase powers, and extension of time for completion of railway and works.

North-East London Railway Co.—Extension of time within which capital is to be subscribed and works commenced.

North-West London Railway.—New railway, variation and abandonment of railways and subway; extension of time; working and other agreements with, and leasing by, the Baker Street and Waterloo Railway Co. Agreements with local authorities and companies as to supply of electrical energy.

Ravenglass and Eskdale Railway.—New company to acquire existing undertaking. Powers are sought as to electric traction, and as to agreements for supply of electricity.

Watford and Edgware Railway.—Amendment of 1906 Act, extension of time, authority to enter into agreements with Edgware and Hampstead Railway Co., Charing Cross, Euston and Hampstead Railway Co., and the Underground Electric Railways Co. of London, Ltd.

Telephone Arbitration.—Powers to the Railway and Canal Commission to determine differences between Postmaster-General and N.T. Co., Ltd., as to purchase of the plant, property, and assets of the latter.

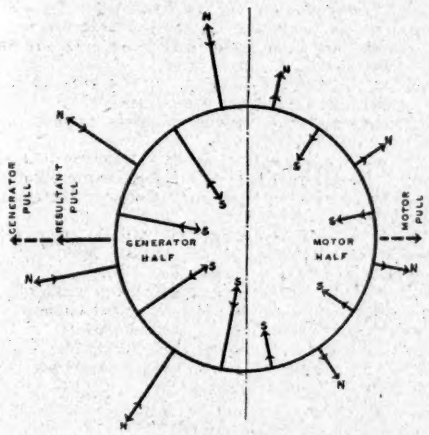
PROCEEDINGS OF INSTITUTIONS.

The Testing of Alternators.

By Stanley P. Smith, B.Sc.

(*Abstract of Paper read before the* Institution of Electrical Engineers, *Birmingham, November 11th*, 1908.)

The author refers to the difficulty of testing large alternators by a modification of the Hopkinson method, and describes a method by which accurate results can be obtained on a commercial scale. The only method in use to any extent is that of Behrend, wherein the field magnet system is divided into halves, and the full-load current is passed through each half from the mid-point; under these conditions no current can flow in the short-circuited armature circuit, if the winding is symmetrical. The current in one branch is then gradually reduced, until the desired current flows in the armature circuit. This method, however, has the defect that the machine is magnetically unbalanced, as shown in fig. 1, not only at no-load but also at full-load. That this is so, in spite of the apparent neutralising effect of armature reaction, which strengthens the motor field and weakens the generator field, is readily seen from consideration of the fact that if the motor side pull equals the generator side pull, the respective magnetic fluxes must be equal, in which case no E.M.F. can be generated in the armature.



16-pole machine.

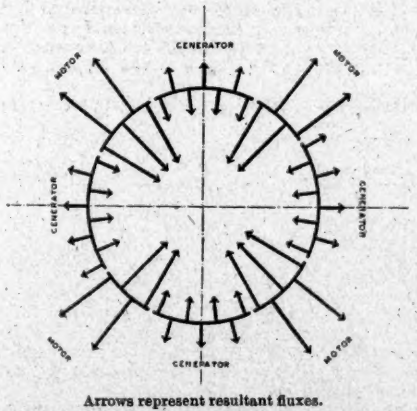
Resultant magnetic pull = pull on generator side − pull on motor side.

N = North Pole. S = South Pole.

No-load conditions. —→ = Flux in generator pole due to field ampere-turns. —→ = Flux in motor pole due to field ampere-turns.

Short-circuit conditions. —←→ = Resultant flux in generator pole due to field and armature ampere-turns. —→→ = Resultant flux in motor pole due to field and armature ampere-turns.

Fig. 1.—Diagram Showing Unbalanced Stresses in Behrend's Method.



Arrows represent resultant fluxes.

48 poles. 30 generator poles *versus* 18 motor poles.

Fig. 2.—Diagram Showing the Author's Method of Testing Alternators.

The unbalancing may not give trouble in the case of large low-speed alternators; but with high-speed machines the vibration set up is dangerous. A large three-phase generator, 6 600 volts, 342 amperes, cos ϕ = 0·9, with 12 poles, and running at 500 R.P.M. was recently built and tested at Messrs. Siemens Brothers' Dynamo Works, Ltd., Stafford. On applying Behrend's methods of testing, it was found impossible to run the machine even at a low load at anything like the normal speed, owing to the severe vibrations of the stator.

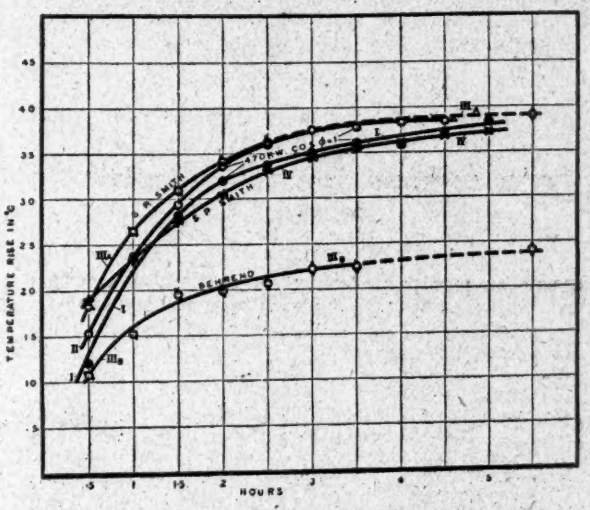


Fig. 3.—Curves Showing Temperature Rise of Stator Core in Similar Machines Tested by Various Methods.

The author then modified the test, symmetrically disposing the motor poles amongst the generator poles, so that the whole revolving system was balanced with respect to the shaft, and this proved satisfactory mechanically, but not electrically; for the current in the motor fields being only 10 or 20 per cent. of the normal value, the heating is not normal, and the difference in the case of the high-speed machine above mentioned (which had to be totally enclosed to reduce the otherwise intolerable noise) due to this would be considerable; further, the core losses in the stator iron are not normal, and the resulting temperature rise, as shown in fig 3, is incorrect.

To overcome these objections, the author devised an alternative method. There must be no dangerous resultant pull with respect to the rotor shaft, and the full-load exciting current must be employed, with full-load armature current and full-load core losses, in order that correct results may be obtained for the temperature rise and efficiency; the exciter also can then be tested under normal

TABLE I.—Temperature Rise of Stator Core in Degrees C. (See curves in fig. 3.)

Machine No.	I.	II.	III A.	III B.	IV.
Conditions of test. Time in hrs.	470 KW. (cos ϕ = 1·0).	470 KW. (cos ϕ = 1·0).	Smith's* test (18 poles *v.* 30 poles).	Behrend's † test (24 poles *v.* 24 poles).	Smith's * test (18 poles *v.* 30 poles).
0·5	12·0	15·3	18·3	10·7	19 0
1·0	23·5	23·6	26·5	15·2	23·3
1·5	28 2	23·7	31·0	19·5	27·5
2·0	32 0	29·4	34·1	19 9	30·5
2·5	33·7	36 0	36·3	20 7	33·0
3·0	35·0	37·5	—	22·2	34·5
3·5	36·0	37 8	—	22 4	35·4
4·0	35·8	38·3	—	—	36·0
4 5	37·2	38·4	—	—	36 8
5 0	38·3	—	—	—	37·2

* Losses in both stator and rotor same as on 470 KW. at cos ϕ = 1·0.

† Only stator copper losses same as on 470 KW. at cos ϕ = 1·0.

Note.—Machines I and II tested on dead load. Terminal volts, 2,200; stator amperes, 122; rotor amperes, 111. Machines III A and IV tested by author's method. Terminal volts, 0; stator amperes, 123; rotor amperes, 116. Machine III B tested by Behrend's method. Terminal volts, 0; stator amperes, 122; rotor amperes, 109 in 24 poles, 17 in 24 poles.

conditions. To attain these ends, the author puts all the field coils in series, carrying the full-load exciting current; in a given case, the machine having 48 poles, 18 of these were reversed, acting against the remaining 30, and the distribution was effected as shown in fig. 2, so that the magnetic forces were balanced. With full-load exciting current, the full-load current flowed through the short-circuited armature. Fig. 3, in conjunction with the accompanying table, shows a number of results obtained, the temperature rise being measured at the back of the stator core. The curves show that the temperature rise obtained by the author's method agrees closely with that obtained on a dead load, and numerous later tests have confirmed this. The rotor circuit was opened in eight places, but four places would often suffice as a minimum, as complete balance is not essential; in an 18-pole generator, 7 poles were reversed, with satisfactory results. Oscillograph curves taken with a Siemens & Halske oscillograph are given in the paper, showing the effects of the reversal of polarity, and the method of predetermining the number of poles to be reversed, in order to obtain full-load current on short-circuit with full-load exciting current, is explained.

To determine the efficiency, the machine is driven by a motor, first unexcited, then normally excited on open circuit, and lastly on short-circuit with full-load current, and the driving motor is also run light. From the data thus obtained the individual losses can readily be deduced, as well as the total losses, and therefore the efficiency.

Discussion.

Mr. A. E. Clayton (Stafford), in a written communication, said that the author's method was an improvement on the Behrend method. Whether the iron loss on the author's short-circuit test was equal to the actual iron loss on load could only be determined by experiment. The total iron loss on the author's test was probably a little greater (15 to 20 per cent.) than the normal full-load iron loss, and the efficiency would probably work out a little too low. No account was taken of the increase of maximum flux density in the

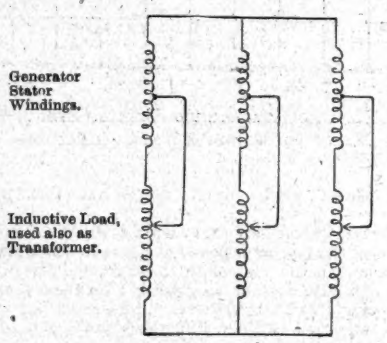


Fig. 4.

gap and teeth due to distortion of the flux wave. It would be best to take the iron losses as equal to the total losses minus the known losses, which could be calculated.

Dr. Sumpner (Birmingham) said that in 1893 he had described a test on a revolving-armature alternator of 100 kw. output, having 20 poles. In one case the poles were divided into two equal halves and excited by unequal currents; in a later test eight motor poles and 12 generator poles were used, coupled up so as to be excited by the same current. There remained the possibility of simply dividing the poles into two adjacent sets and of independently adjusting the ratio of the number of poles, and the ratio of the two exciting currents, so as to secure both equal fluxes and the right armature current. Under such conditions, the core losses and core heating would be normal, and it would be easy to allow for any difference in coil loss.

Mr. R. A. Chattock (Birmingham) noticed that the results obtained by the author's method of test in nearly all cases showed a less temperature rise than was the case when the machines were tested on dead load. He thought that this was an indication that one method was not quite comparable with the other. In purchasing an engine and generator, the buyer did not as a rule trouble himself about the efficiency of the generator by itself; what he wanted to know was how many lb. of steam the engine required per kilowatt output of the generator at various loads, and at various power factors. To ascertain this, it was necessary to use a non-inductive load with an arrangement for adjusting the power factor. The cost of carrying out such a test in a generating station, where, of course, the power could be obtained at a very reasonable figure, over a six hours' run on a 1,500-kw. generator amounted to from £6 to £8. At the Birmingham station they periodically tested all the machines, and he considered that the cost and inconvenience of opening up the field windings, and making the necessary arrangements for the test described by the author, would render it almost impossible to adopt this method in generating stations. From a manufacturer's point of view the test might be very valuable.

Mr. Orsettich (General Electric Co., Birmingham) said that shortly after the publication of the Behrend method he had tested two large alternators, using different numbers of poles on motor and generator sections, and unequal field currents. In doing this they aimed to obtain equal fluxes and normal core loss. The test was satisfactory and the machines were accepted. There was no trouble due to vibration, although in larger machines he had tested it became noticeable. There were several disadvantages connected with the author's test. The large number of openings was a serious objection, especially at high speeds. The distribution of flux being different, the core loss was affected. Where saturation of the teeth was high, unequal flux distribution would further affect this loss. The leakage was very different to what it would be under normal conditions. He did not agree with Dr. Sumpner that the copper loss could be determined by calculation based on the resistance; the heating of the copper would depend on the heating of the magnets and on the ventilation, as well as on the exciting current. In designing machines it was necessary to reduce the amount of copper used as far as possible, particularly in the field coils, and it was, therefore, important to use the maximum exciting current during the test.

Mr. R. A. Everest (B.T.-H. Co., Rugby) said that it was quite possible to predetermine the heating of a machine on full load from observations of runs made on open circuit and on short-circuit. When running on open circuit, preferably at 10 or 15 per cent. above normal voltage, the heating was observed on the stator core and on the field windings, and also that on the inactive stator windings, due to conduction from the hot core and to the warm air from the fully-loaded field windings. The short-circuit run, during which the core loss was negligible and the field losses also small, showed the heating of the stator coils arising from their own loading, and the heating of the core due to the loaded coils. By combining results, the heating on full load when both core and coils were active could be accurately predetermined. He had applied the method in a number of cases, subsequent full load tests always giving results closely in accordance with the values predicted.

Dr. Kloss (Siemens Bros., Stafford) said that up to the present the method had been systematically applied only by Siemens Bros. He hoped that other firms would follow, and that the method would be adopted as a standard. It was not definitely clear whether the total iron losses in the machine on open circuit would be higher or lower with the Smith method than when running under normal conditions of field. When the machine was short circuited the iron loss might well be greater than under ordinary load. This, however, was fair towards the customer, as the machine would actually be tested under worse conditions than with normal load.

Dr. D. K. Morris (Coventry) said the drawback to the Behrend type of test was the irregularity of the magnetic conditions occurring wherever the field winding was opened. The recent paper by Mr. R. K. Morcom and himself had shown that a test was now quite possible in which the points of the open-circuit and short-circuit tests were combined, while at the same time hardly any power was required. It was merely necessary to connect the alternator to an inductive load of the type described, running the generator at full voltage and current and at approximately zero power factor.

Dr. Morris, in a subsequent written communication, suggested that the inductive test could be modified in the simplest manner to give circulating power in conjunction with inductive load. The mid-point of each phase of the main generator winding could be connected with a point slightly removed from the mid-point of each choking coil. In-phase circulating current would then flow, one-half of the alternator winding acting as generator and supplying one-half of each of the choking coils with energy, which would be transformed and delivered back by the other or secondary half of each coil of the remaining half of the generator windings, as in-phase motor current (see fig. 4). Rather larger choking coils (say, by 40 per cent.) would be needed for such a test than for that of zero power factor. But very much larger transformers still (six or seven times as large) would be needed if an attempt were made to do a similar test without the out-of-phase component of current. The test could conveniently be arranged at as high as 75 or 80 p.f. The field windings would not be interfered with in any way.

Mr. A. T. Bartlett (Birmingham) said that it would be a great advantage to have a recognised test that could be put forward and accepted without question by engineers generally. In his opinion the Behrend test included splitting the field into unequal parts; he had experienced vibration troubles, due to unbalanced forces, and on this account he had already arranged tests in which the field was split into four parts.

In his reply, to be communicated to the next meeting the author says the question of core losses has not been overlooked in his paper, as it will be seen that he regards it as the criterion of the test. He agrees with Mr. Clayton that the iron losses when running on open circuit will be slightly less than when the poles are normally connected and excited with the same current. The later tests all show that the full-load iron losses usually come out from 15 to 25 per cent. too high compared with normal conditions; this will not have a very great effect on the total, and it is on the safe side from the buyer's point of view. He does not think any advantage would be gained by dividing the field into two parts only and trying to obtain equal fluxes by using different exciting currents; this method might easily result in an increase of 50 per cent. above normal in the rotor copper losses, and this would also affect the temperature rise of the stator. The sum of the two exciting currents would be considerably greater than the capacity of the exciter; and if one of the field circuits became broken, which might happen with the temporary connections used in a test house, the results might be disastrous. He finds that the temperature rise with his method is a trifle higher than the actual, which is, no doubt, due to the extra iron losses. He does not think it possible to apply the test to machines having less than six or eight poles. He is inclined to believe that the results obtained by Mr. Everest's method of testing were accidental, for neither on open circuit nor short circuit did correct heating or cooling either in stator or rotor obtain.

Domestic Electricity Supply Tariffs.

By W. R. Cooper, M.I.E.E.

(*Abstract of Paper read before the* Institution of Electrical Engineers, *London, November 26th*, 1908.)

The tariffs at present in vogue have been devised mainly for consumers requiring light, and offer little encouragement to the extension of electric heating and cooking. The flat rate is simple, but renders the cost of heating and cooking prohibitive. The maximum demand system was formulated by Mr. Arthur Wright when lighting alone had to be considered, and was sound in principle, but the popular difficulty in understanding it has led to the offer of an alternative flat rate which robbed it of its value; it also restricts the use of the supply for other purposes, and takes no account of the time at which the supply is taken. Combining a flat rate for cooking and heating with a maximum demand rate for lighting has the disadvantage of requiring a duplicate meter and separate wiring. The "contract demand" system of Messrs. Handcock & Dykes also is not suitable for domestic supply.

No tariff will eliminate the peak-load due to lighting; but the domestic power load may be developed so as to render the peak unimportant. In a house fitted with 80 30-watt lamps the maximum load is, say, 1·5 kw.; a single radiator and a teapot make a load greater than the whole of the lighting, so that a domestic power load three or four times as great as the lighting load is not beyond possibility. The tariff to cultivate such a load must be simple, uniform for lighting and power, independent of a maximum demand, and yet capable of discriminating between the lighting and the power load, for the heavy capital charges and inefficient production in the case of the lighting supply cannot be disregarded.

The charges peculiar to the peak load must be provided by a special yearly payment, the rate per unit being otherwise small and uniform.

Mr. F. M. Long states that the annual consumption amounts to about 7 units per £ of assessment in Norwich and charges 12 per cent. on the net rateable value plus 1d. per unit. At Wrexham the charge is 12½ per cent. and 1½d. per unit. The rateable value of a house, however, has little to do with its electricity supply.

The two-rate meter system discourages a peak load, but, unfortunately restricts the use of electricity for heating and cooking as well as for lighting, and does not provide a satisfactory solution.

An annual charge per kilowatt of lamps installed, plus a small charge per unit, possesses advantages, but necessitates inspectional visits at intervals. The charges would be, say, of the order of 4s. per 30-watt lamp per annum and 1d. per unit.

The flat rate part of the tariff must not be fixed too high; under ordinarily favourable conditions, the cost of generating energy for domestic power supply will fall between the limits of 0·43d. and 0·78d. per unit, the load factor of this supply being 25 per cent. Allowing the cost of additional plant and mains to deal with domestic power supply to be £50 per kilowatt, interest on the capital outlay will bring the total cost of the supply to a value between 0·77d. and 1·12d. per unit. In many cases ¾d. per unit for the flat rate part of the tariff might be adopted with advantage.

To heat a room of 1,500 to 2,000 cb. ft. requires ¼ to ½ cwt. of coal per day of 12 hours, costing 4½d. to 5d. per day. A radiator consuming 1 kw. would take 12 units if kept full on, or 9 units if used at half-rate for half the time. The heating of houses on a large scale electrically cannot, therefore, be expected with electrical energy at present prices. The radiator, however, has the advantages of cleanliness and portability, and is very suitable for heating small rooms and bedrooms. Bodies of water might be heated at a cheap rate during the night, giving out the heat during the daytime.

The electric flat iron, extensively used in America, always clean and at the proper temperature, appeals strongly to the housewife. The revenue derived from them is considerable, and they provide an essentially daylight load.

Information should be furnished to possible consumers not merely as to the cost of cooking apparatus, and the cost of cooking with it, but also as to the cost of cooking with coal or gas—particulars of which he knows nothing, though he uses these agents. The average kitchen range is a most inefficient apparatus; it has the one virtue that it provides the supply of hot water as a by-product. In a household of eight persons it was found that 125 gallons of hot water were used per day, at a temperature of about 125° F. The efficiency of the ordinary hot water system is extremely poor; if electric heating were adopted, an efficient system could be installed, but the cost of the energy (29 units in the case cited) is prohibitive. At ½d. per unit the cost would be 1s. 2½d. per day, whereas coal for cooking and heating water cost only 9½d. per day.

Electric cooking, apart from heating water, is exceedingly clean, controllable, and certain; unlike gas, it imparts no taint in grilling, and produces very little smell, while it is cool and can be employed in any room. Miss C. D. Seaver's experiments* on cooking meals showed that electricity at 2d. per unit cost about twice as much as gas at 4s. per 1,000 cb. ft.; Mr. J. R. Cravatt† found that electric cooking at 1½d. per unit cost more than gas at 4s. 2d. Mr. E. H. Callahan stated that the watt-hours per person per meal were 264, and other data show that 300 watt-hours is a safe figure. Messrs. Isenthal & Co. find that the cost of cooking for three persons is about 2·21d. per day, at 1d. per unit.

The high cost of electrical heating and cooking apparatus retards development, but cheap inferior apparatus is still more harmful. The electric hot-plate, which can be used for heating ordinary utensils, should be put forward as a means of educating the householder. Figures supplied by the General Electric Co. show that the efficiency of a self-contained vessel for boiling water is 87—92 per cent.; a vessel in good contact with a hot-plate has an efficiency of 84½ per cent.; but if the contact is bad, the efficiency may fall to 32 per cent.

Hiring out the simpler forms of apparatus for heating and cooking, like the gas companies, is a good policy; the use of such is certain to extend largely in the near future. Hotels are more easily interested in electric cooking than private houses. A test by Mr. J. Fleming shows that an electric grill used three units, while a gas grill consumed 75 cb. ft. of gas, the cost being respectively 3½d. and 2½d. (at 1½d. and 2s. 10d.).

* Electrical Review, February 8th, 1907, p. 243.

† Electrical Review, September 27th, 1907, p. 552.

Discussion.

Mr. C. P. Sparks, who opened the discussion, considered that the author's figures as to the use of the maximum demand and flat-rate systems of charging were misleading, the flat-rate system being more generally used. The author commented on various systems of connecting heating apparatus, and the corresponding methods of charging, but he (the speaker) thought the most generally adopted method—double circuits and meters—had not been referred to. It was difficult to obtain data on which to estimate the wattage of an installation, as consumers objected to inspections, and practically prevented them. Many people were paying less than 2d. per unit, with the present duplicate meter service, for heating, &c., but the great difficulty was the first cost of the heating and cooking apparatus. For this reason he regretted that the efficiency of the hot-plate and separate vessel was only 32 per cent., as the use of this piece of apparatus with ordinary cooking utensils might solve the difficulty. He held that cheap apparatus was of more importance than doing away with duplicate wiring.

Mr. A. M. Taylor (communicated) referred to the Richmond peak load diagram given by the author, which, Mr. Taylor agreed, need not have been there, if the company had adopted batteries when making its last extensions. He disagreed with the author's table of estimated costs for domestic power supply, believing that the highest estimate was nearer the possible low limit; he also questioned the chance of there being a 25 per cent. load factor for domestic service, and considered that the cost of additional generating plant would be nearer £85 than £50 per kw.

Mr. J. F. C. Snell agreed as to the excessive cost of electrical cooking apparatus, which was not so simple or robust as that commonly used with gas. He thought there was a tendency to overlook domestic heating and cooking by electricity. He also disagreed with the author's estimated costs as regards domestic power, as there was no allowance for redemption of capital; and he further deprecated the use of "by-product" prices.

Mr. H. W. Handcock, who followed, took exception to the author's remarks on the "contract demand" system of charging, but he agreed that there could be no hard and fast rule. The makers of heating apparatus must greatly improve it before the average domestic would be able to use it with impunity. The most promising field for domestic heating was really among consumers who could not afford to pay for their own wiring, and if supply authorities went to the extent of free wiring there would be a further increase in financial charges.

Mr. Edward Cowan held that electricity should be charged according to its commercial value, which he defined as that point in the relation between the "desire to possess" on the part of a consumer and the cost of supply at which business resulted. He knew that this was contrary to the opinions of many authorities, who favoured the view that the selling price should accord with the cost of supply. In support of his argument he adduced ordinary commercial operations, in which price was a measure of value. He pointed out that a man might want light, heat or power, and the price he would be prepared to pay would depend upon the cost of other forms of light, heat, and power, and upon the comparative convenience of the electrical form; the fact of electricity being the particular agent was immaterial. Cost of production and supply, load factor, diversity factor, &c., would influence the matter, and the tariff would be framed upon the basis of the strength of the demand and the cost of supply; in other words, it would be adjusted to such a value as coincided with that relation between the strength of demand and cost of supply which would, on the whole, secure the best business. The question of equitable treatment as between consumers did not come into the problem at all, as, if the charge was according to value, justice would be secured to all. It was, of course, necessary to frame and administer the tariff so that low priced units did not, to any serious extent, displace high priced units. The problem should be treated as a *collective* one, and not as an aggregate of individual problems.

Col. Crompton said it was necessary in framing tariffs (and having regard to the last speaker's remarks) to consider how far the Board of Trade would allow an adjustment. Thus, 8d. per unit was a maximum price, and if a millionaire used a large house, say, for one day a year, it would not be possible to charge him more—although the Norwich tariff would result in a higher charge. He considered that duplicate wiring should be abolished; in West End houses it resulted in heating devices being confined to one or two rooms only. It was interesting to note a peculiarity of the radiator, it made you feel warmer than you really were; you were comfortable at a less temperature than with other forms of heating. With things as at present, the easiest way of overcoming the difficulty of charging, &c., was the adoption of double tariff meters. His firm had given up making heating and cooking apparatus, owing to the trouble involved in dealing with people who had allowed kettles, &c., to boil dry. He thought the production of cold by electricity had been much neglected—the problem was more important than heating in hot countries, such as India.

Mr. W. R. Rawlings was surprised at Col. Crompton's reference to abolishing duplicate wiring; there were three or more sets of wiring in many West-end houses supplied by Col. Crompton's Co. As regarded the author's remarks on wattage of lamps, he disagreed with the suggestion that this had any relation to the electricity consumed, as the usage varied very much. The quarterly inspection was also impossible. It frequently took three days to inspect one house. To charge 4s. per lamp, as an annual charge, would penalise about 50 per cent. of the lamps in use in West-end houses, where more lamps were installed than were absolutely necessary, and incidentally the contractor would suffer.

Mr. A. P. Trotter had a premonition that the Board of Trade would be dragged into the discussion. He considered that the price of a thing was what it would fetch, and that the Norwich system was an excellent one.

Mr. W. R. Cooper, in replying, said that it must be remembered that it was the middle-class consumer who offered scope for effort, and the extent of their installations was known fairly well. It would be a simple matter to show existing consumers how a tariff based on total wattage of lamps would affect their account; and as lamps alone were considered, there would be no restriction on plugs. The first cost of apparatus for cooking was a difficulty, which would diminish in proportion to the extended manufacture of the apparatus. A suitable tariff would help towards this end. The figures of costs had been criticised, but it must be remembered that the 1d. limit advocated, was already in use by several undertakings.

The President, in a few concluding remarks, said he thought we had got a little further towards the elimination of the maximum demand system. We were drifting towards simpler methods of charging such as were in vogue for almost every other commodity.

The Electric Driving of Machine Tools.

Mr. A. G. Seaman (British Westinghouse Co.) read a paper on "The Electric Driving of Machine Tools," before the Coventry Engineering Society on November 20th. The condition in which the machine was maintained, he said, had a marked effect on the power required to drive it. In foundries, shipyards, and boiler shops, the estimated power might increase by from 10 to 50 per cent., and he instanced a works recently equipped with electric motors, where the extra power required by the boiler shop showed up at once on the switchboard, leading to prompt overhauling, and a reduction of nearly 30 per cent. in the power taken.

The existence of a limiting speed for a given cut and material, introduced an important consideration into the driving of machine tools when the cutting was being maintained near the maximum value, namely, that the speed of the driving gear should remain reasonably constant under very considerable variations of load. It was necessary, also, to vary the speed of machines for various reasons, and the effect of these combined might necessitate, in large machines capable of dealing with a great variety of work, corresponding speed changes over a very wide range. There was a growing tendency among machine-tool builders to replace the cone pulley by a gear box. A "constant geometrical ratio" most nearly attained the object of enabling any desired speed of the tool to be approximated with a given number of changes, and had been adopted in practice for general work. The smaller the ratio, the smaller was the change of cutting speed which took place with a change of gear, and the more nearly did the average cutting speed approach to the maximum economical speed. The importance of maintaining the maximum suitable cutting speed was not sufficiently realised by users of machine tools. The ideal arrangement would be automatically to increase the speed of rotation as the diameter of the work decreased. The larger the ratio, the more the average speed fell below the maximum, and the longer was the time required to complete the job.

It was obvious that a method which enabled the ratio of speed change to be reduced to, say, 1·05, entailing an increase of only 2½ per cent. in the time of cutting, would enable a saving of 7 per cent. to 15 per cent. to be made in the time of performing a given cut. Such a method was provided by the variable-speed shunt motor, and the question of ratio could be met to any desired extent by increasing, at comparatively small cost, the number of contacts on the regulating switch. The speed could be varied without stopping the work, and no effort on the part of the operator was required to make the changes. These could be made automatically, resulting in much higher efficiency. Tool builders, as a body, had not yet appreciated the peculiar advantage of the variable-speed motor; they regarded it as an extremely convenient but expensive means of dispensing with cone pulleys or a certain number of gears. Those who had gone into the question found that for machines requiring less than about 20 to 25 H.P., they could construct a mechanical change-speed gear box at less cost than was involved in obtaining the same total range of speed with variable-speed motors, and they were surprised that, despite this fact, users sometimes persisted in specifying machines with variable-speed motors down to 5 H.P. and even less. For outputs of 20 H.P. and over, the mechanical gear box became unwieldy, the gears had to run at high speeds, and were consequently noisy, and the cost reached a point where the alternative of the variable-speed motor began to make a favourable comparison. Commenting upon the class of tools with a mechanical speed-change gear driven by a single constant-speed pulley suitable for belting to either a countershaft or motor pulley, or easily adaptable for direct driving according to the requirements of the customer, he observed that such all-geared headstocks were being arranged with 4, 8, 12 or 16 speeds, driven through friction clutches, so that the speeds could be changed without stopping the machine. With such a machine driven by a variable-speed motor, with a moderate range of speed, an almost continuous change of speed could be obtained over the whole range.

In all cases where wide-speed variation was required, individual driving, even for comparatively small powers, was likely to displace other methods, but for other cases well-arranged group driving was likely to be retained, and for this A.C. motors had great advantages.

In some all-geared lathes, the increase of load caused by throwing some of the gear changes was such as to produce a sudden demand sufficient to trip the maximum current cut-out; in such cases fly-wheels might with advantage be fitted to the motors. All motors driving tools through positive geared drives should be provided with maximum current cut-outs, to protect both the motor and the tool.

In planing machines the greater portion of the energy at reversal was not expended in reversing the bed and its load, but in reversing the gear employed to drive it, which, although comparatively light in weight, ran at a relatively high speed. The weights of the reversible parts, therefore, must be reduced to a minimum, and those of the constant running parts arranged with as much inertia as possible.

High speed tools required an amount of power so much in excess of those they replaced, that it was necessary to adopt other methods for driving them, and electric driving had been found to provide the simplest means of supplying this additional power.

The Cost of Getting and Drying Peat for Power Production.

By Thomas Tomlinson, B.A. (I.).

(*Abstract of paper read before the* Institution of Civil Engineers of Ireland, *Dublin, November 2nd*, 1908.)

In an address last year, as chairman of the Dublin Section of Electrical Engineers, I expressed the opinion that recent developments in gas engines, in producer plant, and in by-product recovery combined, made possible the generation of extremely cheap power at the bogs, provided there was a certainty—in our uncertain climate—of obtaining peat carrying 40 to 50 per cent. of water, at a certain price. I expressed the opinion that peat could be got at a price which would be covered by the value of sulphate of ammonia recovered. Unfortunately I was obliged to rely for my figures as to cost of getting peat upon a single authority, and whilst I there stated that the drying of the peat was the problem, I now know that the problem is twofold—getting and drying—and that in both respects the difficulties of the problem are greater in Ireland than elsewhere.

In my opinion the supposed ignorant conservatism of the Irish peasant in peat getting and drying is sound, for the "man with the slane" can—in a dry summer—get and dry peat at a less cost than any machinery that ever came out of Germany.

The problem, as I would restate it, is this:—Is it possible in Ireland to get and dry peat at such a price per anhydrous ton as shall be covered by the net value of the sulphate of ammonia recovered?

The anhydrous or chemically dry mass is used, so that the whole of the figures may be comparable and the results clear.

Table I gives the pounds of water, which, mixed with 100 lb. of anhydrous peat, give a mixture containing 10—20, up to 90 per cent. of water.

TABLE I.

Anhydrous peat in lb.	Water in lb.	Percentages of water in mixture.	Notes.
100	11	10	
"	17	15	
"	25	20	Air-dried peat.
"	43	30	
"	66	40	
"	100	50	Suitable for use in producers.
"	150	60	
"	233	70	
"	400	80	
"	900	90	Peat as dug.

Two points in the above table are worth notice.

1. Peat parts with water readily and quickly, and mostly by drainage to about 80 per cent.; below this it parts with water with difficulty and slowly, and mostly, I think, by evaporation.

2. The enormous proportion of water to anhydrous peat in peat as dug. It would need to be a very valuable commodity which would allow much handling of 10 tons of stuff to get 1 ton of material. Anhydrous peat is not an excessively valuable commodity in Ireland in competition with English coal.

According to the analysis of peat samples from the Bog of Allen, one ton of anhydrous peat would give 14,500,000 B.TH.U. in gas and 85 lb. of sulphate of ammonia as a recovered product. The gross value of the 85 lb. of sulphate of ammonia is 8s.; the net value is 4s. If, then, we can get our peat at 4s. or less per anhydrous ton, we shall have power at the rate of 14,500,000 B.TH.U. (= 1,700 I.H.P.-hours at 30 per cent. thermal efficiency of conversion in the gas engine) per anhydrous ton of fuel, free. This would enable power to be delivered close to the generating station at prices comparable to water power prices.

By no known and practised system of peat getting and drying can peat be delivered all the year round, independent of seasons, and

in such quantities as would be demanded by a power station at such a price.

The recent publication of the valuable report "Peat and Lignite" (see Electrical Review, September 4th, 1908) made by Mr. Nystrom for the Canadian Government, has given me the opportunity of ascertaining the costs of production in various parts of Europe, and by different processes, got on the spot by a most competent and impartial observer.

I have deduced the cost per ton anhydrous from the cost per cubic yard by using as a conversion factor, 13·3 cb. yd. *in situ* contain 1 ton of anhydrous peat. This leads to a very simple relation: 40 cb. yd. *in situ* weigh 30 tons, and contain 3 tons of anhydrous peat.

As a matter of fact, the amount of anhydrous peat per cubic yard varies, of course, with the wetness of the bog. The figure 13·3 is excessive for a well-drained bog, and the cost per ton anhydrous for hand labour in a well-drained bog, too high.

Returning to the figures of cost, I submit the following as fair deductions:—

1. Peat at 4s. per ton anhydrous is—on any known practical lines in operation on a practical scale—not possible.

2. The "man with the slane" will lay out for drying a cubic yard of bog at a less cost than any machine will do it.

3. This cost is 3d. to 4d. per cubic yard, alike for man and machine, and the minimum cost is about 3s. per anhydrous ton of peat laid out for drying.

4. Pulping or macerating the peat accelerates the rate of drying, and gives a denser sod. This is the advantage of machine-made over hand-made peat.

5. The fact that the use of machinery does not reduce the cost of peat getting is due broadly to the fact that machinery is employed under the very worst possible conditions.

Into the cost of briquetting peat I do not propose to enter; briquetting peat in Ireland in competition with British coal is a thing very much better let alone.

Of one system of drying peat I have yet to speak; this is the Ekenberg wet carbonising process. Mr. Nystrom, in his report, alluded to it thus:—"As far as can be judged at present, it is the most promising process for the conversion of peat on a large scale into fuel."

The process depends upon the fact, discovered by Dr. Ekenberg, that raw peat (say 90 per cent. water) when subjected to a temperature of 150° C., carbonises, and, when subsequently submitted to pressure, parts readily with the contained moisture and is readily briquetted. Dr. Ekenberg, therefore, boldly proposes to treat his macerated bog stuff as boiler feed.

I commented upon the process in the Electrical Review of September 18th, 1908; I have only to add, with fuller knowlege, that I devoutly hope the bog-boiling experiments will be confined to Sweden.

No known system will give peat at 4s. per anhydrous ton, and "the man with the slane" goes nearest to it in an exceptional season (at about 6s.), because he does just the minimum of work necessary to enable the natural force of drainage and evaporation to get to work.

Plans and sections of an actual Irish bog are given in "The Report of Bogs in Ireland," presented to Parliament in 1810-13, which is a perfect mine of information.

The bog lies in a saucer-like depression, and is drained by several streams. The bottom of the saucer is above the level of the country outside the saucer, so that the bog admits of easy drainage. The highest, deepest and wettest part of the bog is in the interior. The bog is, or was then, undrained, and cutting of peat had gone on and was going on on all edges of the bog. The bog had even then been extensively cut for fuel, and the cut away portions had been reclaimed. The cutting of peat had been stopped at a certain level, determined, as I think, by the level of a drainage gap on the enclosing saucer. All these facts are quite characteristic of Irish bogs, and the plan and sections may be taken as fairly typical.

The cut faces of such a bog, although apparently dry at the outside crust, are sodden wet at a distance of a few feet in, kept so, undoubtedly, by the flow of water through the bog mass from the highest and wettest part. If, now, you drain such a bog, what you do, in effect, is to carry the surface water away so rapidly that less sinks through the bog mass, and so you dry the bog and the cut faces. In addition, the drains, as it were, bleed the bog at the cut faces of the drains.

The plan of peat drying *in situ* suggested by the examination of conditions as above cited is essentially:—

1. Cut off the supply of water from the high-lying saturated bog.

2. Carry away the rainfall.

3. Drain away the water which runs from the cut faces.

4. Go right down to the bottom of the containing saucer; the best turf is below the lip.

5. Allow the natural forces of drainage and evaporation full play.

The proposed method of procedure is as follows:—Parallel lines of drains, 3 in. to 6 in. wide, are driven through the bog, leaving 3 ft. to 6 ft. walls between. The drains to be as narrow as can be ecoomically dug. The walls to be as broad as will allow of their drying in a reasonable time.

The drains are at first cut down to a depth at which the surcharged vertical wall will stand (say 5 ft.). The drains are then deepened, step by step, always keeping the drains at the proposed cutting face deeper than those further back. The bottoms of the drains would, in practice, follow the hydraulic gradient of flow through the bog mass.

As these drains are gradually deepened, the intervening walls, on account of the loss of moisture by evaporation and drainage, will contract in height and breadth, and will crack longitudinally. As to the amount of this contraction, Mr. Nystrom gives 13·3 cb. yards as contracting to 4 cb. yards.

The vertical contraction will reduce the amount to be excavated in the drains and the depth of excavation, the contraction in breadth will open up the interspaces to air circulation, and the longitudinal cracking will open up in the walls crossways for air circulation and drainage.

It will be absolutely essential to drain the foot of the walls, by cutting a drain through the lip of the saucer containing the bog into the nearest watercourse.

Peat containing 50 per cent. of moisture can certainly be used in producers, and when so used, by-product recovery is possible as a help towards the cost of getting and drying. If the peat can be dried down to the degree required with certainty in any season without the help of the waste heat of the gas engine, as I originally proposed, then this waste heat will be available for the evaporation of the water from the sulphate of ammonia recovered—for which purpose about one-quarter of the peat gasified would otherwise be required—leading to a very obvious economy in working.

The author submits that no system of treating the whole bog mass mechanically is likely to beat the proposed system for cost, and he hopes that one of the public departments will carry out the cheap and simple experiment which would prove or refute his substantially-based theory, if only on the ground that the shrinkage of that part of the bog, which has been isolated from the remainder for the purpose of drying *in situ*, if it could be brought about in such a simple manner as described, would reduce materially the labour and time taken to get and dry the turf which provides fuel for the domestic hearth of the inhabitants of the major portion of Ireland.

I cannot see how the cost can exceed 2s. per anhydrous ton standing ready for transport to the producers, or how the cutting-down and carriage in bulk of the peat and its breaking or cutting up into suitable size, can exceed a further 2s. In fact, the probable cost will be under 4s., and may go so low as 2s. 6d. per anhydrous ton.

LEGAL.

Arthur *v.* Henderson.

In the Official Referee's Court, at the High Courts of Justice, on Monday, November 22nd, before Mr. Pollock, Mr. Robert Arthur sued Mr. Alexander Francis Henderson for the sum of £931 in respect of the electric lighting of the Grand Theatre, Fulham. It appeared from the story of Mr. Rose Innes, counsel for the plaintiff, that in August, 1897, a Mr. Pike granted the lease of the theatre in question to Mr. Henderson at a rent of £2,000 a year, under which Mr. Henderson gave several covenants for repairs, including those to the electric light. In October, 1904, negotiations were entered into for the transfer of the lease of the theatre under a sub-lease from Mr. Henderson to Mr. Arthur, the plaintiff in the action. In November, 1904, plaintiff became the tenant, and it was agreed that the electric light should be tested, and if not in good condition, should be repaired by Mr. Henderson. This provision was stated in a letter between the parties at the time the counterpart of the lease was signed. The test took place on December 30th of that year, and the lighting installation was found to be in a dangerous condition and would not pass the London County Council test. Plaintiff had to employ a firm to right the defects, at a cost of £931. The defendant, however, repudiated any liability in the matter, declaring that there was no agreement expressed in the letter referred to.

Counsel for the plaintiff explained that this action was one of others in which plaintiff was seeking an order that the indenture of the lease might be delivered up and cancelled, on the ground of misrepresentation.

Electric Light, Power, and Hiring Co., Ltd., *v.* Maidstone Palace of Varieties, Ltd., and Others.

On Saturday, November 28th, in the King's Bench Division, before Mr. Justice Jelf, counsel on behalf of plaintiffs moved for judgment in the case of the Electric Light, Power, and Hiring Co., Ltd., and the Maidstone Palace of Varieties, Ltd., and the Building and Furnishing Agency, Ltd. Plaintiffs' case was that, in pursuance of a written agreement, dated March 4th, 1908, they fitted up the Maidstone Hippodrome, Gabriel's Hill, Maidstone, with the following plant and machinery:—786 lights complete with fittings, four stage arc lamps, one stage switchboard for controlling lights on stage and auditorium; one special electric lighting type gas engine, having an output of 68 B.H.P. with town's gas, and 55 B.H.P. with producer gas; one 70-B.H.P. suction gas producer plant, with all necessary appliances; one 40-KW. compound-wound dynamo, for 210 volts, at 220 R.P.M., fitted with flexible coupling for coupling direct to engine shaft; and one engine-house switchboard, with the necessary instruments, switches, and fuses, the engine fitted with air and exhaust silencer, self-starter, and electric ignition, and so arranged that the engine could be worked either from town or producer gas. Defendants agreed to hire this plant for five years from the date of its completion at an annual rent of

£690, payable monthly, with 10 per cent. per annum interest upon all overdue payments. The plant was completed on March 31st, 1908, and on April 11th defendants paid £57 on account. The agreement also provided that if defendants made default in punctual payment of any sum, or should mortgage the premises, future payments should, after notice in writing, become payable on demand. Both these contingencies had arisen, and the defendants had failed to pay the rent, except the £57 mentioned. Plaintiffs accordingly brought their action for the recovery of the rent for the five years, with interest to date. On August 13th, a Master's order was made (confirmed by Judge in Chambers on August 20th) that if £1,500 was paid into Court within 14 days, defendants might defend the action as to the whole of plaintiffs' claim, but if not, plaintiffs should be at liberty to sign judgment against defendants for that amount, defendants having the liberty to defend the action as to the residue. Defendants had not complied with that order, and plaintiffs had accordingly signed judgment for £1,500. There was £1,913 still due on the claim.

Judgment was now given in default of defence for that amount, with interest, for the return of the plant and machinery, with an injunction restraining defendants from removing or in any way dealing with the plant and machinery, of which Mr. William Paul Theerman, of Manchester, was to continue Receiver under an order made by Mr. Justice Channell.

Fig. 1.

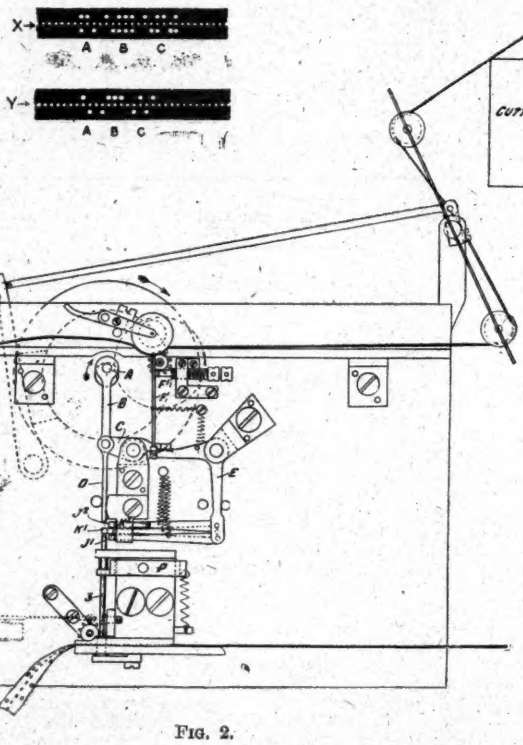


Fig. 2.

Oil Traveller's Claim.

In the City of London Court on Tuesday, before his Honour Judge Rentoul, K.C., a claim was made by Mr. Harry A. Cobbett, traveller, 43, Oxberry Road, Fulham, against Robert Leggatt and Co., Ltd., and the British American Cotton Oil Co., Ltd., Dashwood House, Old Broad Street, E.C., to recover £49 for damages for wrongful dismissal. The action only proceeded against the second defendants, as the others had not been served, being a Glasgow company. Plaintiff's case was that he had been in the service of the Vacuum Oil Co., Ltd., as a traveller at £4 a week, and defendants suggested that he should enter their service to call upon electrical companies using oils in London. He was paid £3 10s. a week by defendants, with a commission of 2½ per cent. on all oils sold above 1s. per gallon and 1 per cent. on oils sold under that price. He worked for the defendants for six months, and in trying to introduce a new company's oils many difficulties arose. He sold their transformer oils after much persistence, but they were rejected. Defendants' cylinder oil burned at a low temperature, and the customers would not give repeat orders. After six months' work, during which his sales amounted to £167 and his expenses to £141, a new arrangement was made with him by which he was paid £2 a week and 10 per cent. commission on oils above 1s. per gallon, and 5 per cent. on those under. Then the defendants put an end to his agreement by giving him a fortnight's notice, and he claimed to be entitled to at least three months, according to the custom of the trade amongst travellers. He now demanded damages for wrongful dismissal. Defendants declared that plaintiff was not a salaried servant of the company at the time of his dismissal. The £2 per week was paid out of kindness by the managing director of the defendant company, named Perrott, and plaintiff was simply working on a commission basis. That being so, he was entitled to no notice to put an end to his contract. Plaintiff was an unsatisfactory traveller, and that was why they dismissed him. They did not take him away from the Vacuum Co. The jury, after a long trial, found for the plaintiff for £12 1s. 11d. and three months' commission, to be based on the money he had earned during the last three months he had worked for the defendant company. He was also given his costs.

A Manchester Tramcar Accident.

The Manchester Corporation, as the result of a trial at the Assizes now being held, has to pay £200 for a very simple accident. Some months ago John Lasser, an agent and debt collector, was an inside passenger by a car which left the city for Ashton-under-Lyne. In Gorton Lane, at the spot where there is a compulsory stop, the car collided with the wheel of a bread van, which had fouled the metals. The impact was not severe, as everyone admitted, for the car was pulling up, and only overshot the mark by a few feet, owing to the lines being greasy. The effect, however, according to Lasser's evidence (which was taken by commission before the trial, the man being unable to stand), was to jerk him off his seat, and, in falling, his back somehow struck the woodwork of the car. He was a little stunned, but proceeded on his journey for some distance; but ultimately he left the car and returned home. A doctor who was called in ordered him to bed. He has been confined to bed ever since, and, according to medical evidence, is no better now than he was three months ago. His ailment, the doctors on both sides agreed, is acute neurasthenia. The extraordinary thing was that no other passenger on the tramcar was inconvenienced by the accident, and no damage was done to either vehicle. The jury nevertheless found that there had been negligence, which resulted in the injury to the plaintiff.

Counsel in the case were:—For the plaintiff, Mr. Taylor, K.C., and Mr. Atkinson; for the Corporation, Mr. Langdon, K.C., and Mr. Rhodes.

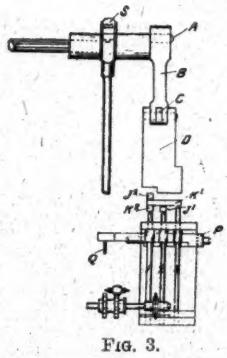


Fig. 3.

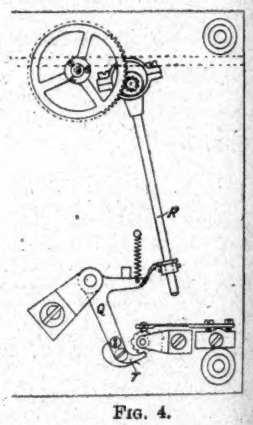


Fig. 4.

The Creed Telegraph Translator.

THE CREED TELEGRAPH TRANSLATOR.

This instrument is used in conjunction with the "Creed receiving perforator" (see Electrical Review, June 14th, 1907) for automatically producing another slip perforated with signals as used for automatic transmission on cable circuits. For instance, the letters A B C are received from the "Creed receiving perforator" on a tape, as shown at X, fig. 1. This slip passes directly into and controls the Creed translator, which perforates a second tape, as shown at Y, fig. 1.

The utility of such an instrument is, of course, at a cable station, where the one or more landline feeders are worked with the unequal dot and dash system, and the cable circuit with the equal positive and negative impulses.

A front view of the mechanism of the instrument is shown in fig. 2, a side view of the punches, &c., in fig. 3, and a back view of the feed for the cable slip in fig. 4.

A small electric motor is used to give the required motion to the star-wheel spindle in the upper part of the instrument for driving forward the received perforated slip, and to provide the power necessary to actuate the striking bar which operates the punches. Geared to the star-wheel spindle is another spindle fitted at its front end with an eccentric pin A, which gives an upward and downward motion to the connecting rod B, and the striking-bar D; also a rocking movement to the lever C. Situated to the right of C are two bell-crank levers E, each carrying at the end of its upper arm a selecting needle F. The lower arms are fitted with rods whose left-hand extremities, when required, take up a position in the path of the striking-bar D, which is then enabled to actuate the punching and spacing rods 1, 2 and 3.

The ends of the rods connected to the bell-crank levers are shown at J^1, J^2, K^1 and K^2. The first two extremities are connected to the front bell crank lever, and consequently are controlled by the needle which passes through the lower row of holes in the received perforated slip; the other two extremities are fitted to one rod, and are controlled by the other selecting needle. It should be observed that K^2 is attached to K^1, and it may, therefore, be considered that a portion of K^1 is always in position over the first punching rod.

When a dot signal is in position both selecting needles pass through the slip at the same instant, causing J^1, J^2 and K^2 to pass into the path of the striker, while K^1 is removed. Hence, the striker D in its downward movement finds J^2, K^2 and a portion of K^1 over the first punch, while K^1 has moved clear of punch 2 and rod 3. Hence punch 1 alone is actuated, producing a single hole in the upper portion of the cable slip corresponding to a dot signal. The depression of any one of the three punching rods feeds forward the cable slip by one centre hole.

When the first portion of a dash signal is to be translated K^1 and K^2 are moved, and although K^2 comes into line, punch 1 is not actuated because J^2 is not in line; neither is punch 2 nor rod 3 actuated, as K^1 has been moved clear.

When the second portion of the dash signal is in position J^1 and J^2 are moved; hence punch 2 is actuated as J^1 and K^1 are in line. Punch 1 is not actuated, as K^2 is not in line.

For a space signal neither of the selecting needles pass through the slip, hence the striker finds K^1 only in its path, causing rod 3 to be actuated, thus feeding forward a blank portion of slip.

The feeding lever P extends backward into the instrument and limits the upward movement of a bell-crank lever Q, fig. 4. Hence a depression of lever P, by either of the punching or spacing rods, causes the pawl T on the lower end of Q to move one tooth to the left. Rod R rises, and in drawing Q with it, causes T to feed forward the cable slip one tooth of the star wheel.

The translator is set to run at a slightly higher speed than the receiving perforator, thus keeping the slip always in tension, and thereby producing more or less friction on the drum of the driving spindle. By this means the speed of the translator is reduced to that of the receiver.

BUSINESS NOTES.

Manchester Electrical Exhibition.—"Insulating Materials" send us the following opinion concerning their experience at the Manchester Exhibition:—

"We consider the Exhibition has been a success, though, perhaps, not quite so much so as the previous Exhibition at Olympia. It has certainly been a success in bringing us into contact with a number of users, and possible users, of our material, and also in improving through personal contact our relations to, and footing with, numerous existing friends—and more particularly in showing many of our provincial customers, who have never been at our London show room and warehouse, all that is being done and can be done in our material, and the many possibilities of applying our material to new purposes and in new ways. There have been numbers of inquiries which may lead to actual business. It is not in the nature of our business to book immediate orders on an occasion like an exhibition, but we are quite confident that, as a result of the Exhibition, business will be coming in due course, and we shall be quite able to trace what future business may be the result of the Exhibition. At the same time, we must say we feel that the too frequent repetition of such Exhibitions would be likely to pull them down to the level of ordinary trade shows, and that the majority of the members of the National Electrical Manufacturers' Association was quite justified in its original view, expressed when the suggestion of the Manchester Exhibition was first brought forward, that such Exhibitions should not be repeated at shorter intervals than from five to seven years at least, there being plenty of other recognised ways in which to push one's business forward in the meantime, at less expense and personal inconvenience than is involved by Exhibitions."

Fire Tests.—A series of official fire tests with single roller shutter doors was conducted on November 25th by the British Fire Prevention Committee at their Regent's Park testing station, the shutters being subjected to fire at temperatures ranging up to 1,800° F. for a period of 2½ hours, followed by the application of water from a steam fire engine. Mr. W. E. Riley, F.R.I.B.A. (superintending architect to the London County Council), represented the Council of the British Fire Prevention Committee and received the visitors. The official report on the tests will be issued in due course.

Consular Notes.—Algeria.—The British Consul at Algeria, in a recent report, states that two wireless telegraphy stations are to be established permanently at Algiers and Oran, the latter being erected by the Admiralty, the former by the Postmaster-General. The Oran station may accept private messages in time of peace, but it is established primarily as a means of communication in time of mobilisation. The Algeria station will be situated at Fort de l'Eau, some 10 miles east of the town, on the bay, the station at Mustapha being done away with. It will be open to all private telegrams, and will consequently be able to communicate with passing steamers. It will communicate direct with Port Vendres and the Eiffel Tower. Besides these two principal stations which are soon to be in working order, secondary stations will be established at points not yet fixed, and connected with one of the two head stations.

The British Vice-Consul at Bone reports that one of the most successful mining concessions at present in Algeria is the Ain Barbar mine, about 20 miles from Bone. Discovered in 1864, it was worked successfully until the death of the proprietor, when it was sold by his executors in 1874 to an English company, which developed the mine extensively, but owing to the complex nature of the ores (copper, zinc, lead and iron pyrites) and the very low price of copper, the operations were not successful, and after losing a lawsuit with the proprietor of the soil, the mine was put up for sale and bought by the latter. He rented it to the Vieille Montagne Co., who worked it for zinc. At the end of the lease the mine remained idle for some time, but was taken in hand in 1900, and has now been put on a most paying footing. The ores are treated electrically, and the mines in 1906 produced 7,545 tons of ore, which sold for £42,000. The mine now employs over 500 hands. The directorate is in negotiation with the town of Bone for the establishment of a generating plant at Bone; they propose to light the town, run a line of tramways and produce the necessary power for the wants of the mine. At present the electricity is made at the mine, and is somewhat expensive, as the coal used has first to be brought to Bone, unloaded and sorted, and then transported to the mine. The rocky nature of the coast, and the absence of a natural harbour at the mines, prevents ships of any size from anchoring near to load or unload. This can only be done by small steamers of 100 tons, which can come in alongside a small jetty made on the rocks.

Austria.—A combination of English, French, Hungarian and Fiume capitalists propose to erect large electrical works to utilise the water of a fall near Otocacs. A water channel 20 kilometres long is to be constructed to a central station of 36,000 H.P., which is eventually to be increased to 100,000 H.P., in which electrical power will be produced by means of turbines. It is proposed to supply power for lighting and industrial purposes to the towns of Fiume, Abbazia and other Dalmatian towns. The company have, moreover, made proposals to the Minister of Commerce, with a view to the electrification of the Fiume-Moravian Railway.

China.—The Austrian Consul at Shanghai reports that the Chinese Government are proposing to purchase the shares held by private merchants in the Royal Chinese Telegraph Co. It is stated to be necessary to considerably increase the capital of the company for the construction of new telegraph lines in Manchuria and Mongolia. Moreover, it is proposed to modify the cost of telegrams. The capital of the company amounts to 2,000,000 taels at present, of which two-thirds is held by the Government and the remainder by private persons. In former years the company paid a dividend of from 20 to 25 per cent. annually, but in 1906 the dividend declared was only 16 per cent., and in 1907 it was still less. The cause of this decline is stated to be the increased cost of administration due to a re-organisation, and in view of this decline it is wondered how it will be found possible to modify the rates. The Administration stated not long ago that taking into account the extraordinary distances over which telegrams had to be sent, it was impossible to reduce the rates.

Germany.—A recent edition of the *Handels Museum* states that one of the features of the electrical industry in Germany during the present year has been the large increase in capital. During the first nine months this increase amounted to 19,170,000 M., as compared with only 2,980,000 M. in the previous year. Tendencies go to show that the industry is in a comparatively favourable condition. This is not shown so much by the amount of

orders as by the relation of cost of production to selling price. The decrease in the price of copper, as well as of other raw and auxiliary materials, has considerably lessened this cost of production. The exports of electro-technical goods during the year have been gratifying. The quantity exported during the first nine months of 1908 showed an increase of 13 per cent. as compared with the same period of 1907, and the value an increase of 16 per cent. The quantity exported in 1908 amounted to 601,083 quintals as compared with 531,408 quintals in 1907, and the value to 138,610,000 marks in 1908 as compared with 121,350,000 marks in the previous year. Only in the exportation of cables has any remarkable decrease been shown, the exports in 1908 being 241,747 quintals as against 255,810 quintals in the preceding year; the value of these goods exported decreased by 2,460,000 marks.

Phillippine Islands.—The British Consul at Manila reports that the total imports of iron and steel were valued at £500,000 in 1907, an increase of £50,000 as compared with 1906. The United Kingdom and the United States share about 70 per cent. of this total with a slight advantage in favour of the former. Germany is the only other competitor of any importance. In certain branches of this industry the figures for 1905 were abnormal owing to the construction of the electric railroad in Manila. The items referred to are rails, structural iron and steel, electrical and stationary machinery.

A recent report made by a mining engineer, on the staff of the Chief of the Division of the Mines at Manila, contains the following remarks about copper:—"Scarcely a dollar's worth of copper has been produced in these islands since American occupation. Nevertheless, this metal is readily conceded to rank next to gold in importance as a natural asset of the Phillippines. It holds this position both because of its past record, and of its widespread occurrence through the Islands, being a frequent associate of gold in the ores. The non-production of copper of late years must necessarily be attributed to the absence of smelters in the Island and to the difficulties of transportation from the mountain regions, where the ore has been found, to the nearest port from which the product could be shipped to foreign smelters. With the investment of a moderate amount of capital these difficulties can be overcome, either by the erection of a furnace near the mines or the improvement of transportation facilities. The Mancayan copper mines, which are the most important and best known copper deposits in the Phillippines, have lately come under the control of a local syndicate composed of American and British capitalists. This company has applied for and obtained a franchise to build a railroad from Mancayan to Bangar, a town on the Western Coast of Luzon. If this road is built a most important step toward the upbuilding of the mineral industry of the Phillippines will have been taken, for not only is such a road of prime importance to the interests of the copper company, but all of the gold mines of Suyoc and Northern Beugnet will be benefited by it. The Mancayan property is now being thoroughly examined by a mining engineer from the United States."

Lamp Prices.—Messrs. G. M. Boddy & Co., of Liverpool, announce reductions in the prices of their "Metalik" lamps dating from November 16th. Their new patterns of these lamps for high and low voltage are now made in smaller bulbs than formerly, also with shorter filaments supported by elastic loops, so that they stand handling better.

The Armorduct Manufacturing Co., Ltd., of Farringdon Avenue, E.C., have sent us a list of revised prices for their "Gral" metal-filament lamps.

Book Notices.—*Die Telegraphen-Messkunde.* By H. Dreisbach. Brunswick: F. Vieweg & Sohn. Price M. 6.—A very clear outline of the instruments and measurements met with in telegraph and other small current work is obtainable by a perusal of this little book. The numerous practical hints and the concise way in which the tests are described indicate that the writer has a real personal acquaintance with the work, and make the book stand out from the ordinary run of students' text-books. When the descriptions of apparatus, &c., are somewhat incomplete, ample references to the recent technical press are given; but, on the whole, the book is self-contained, and reference to other literature is seldom necessary except for the derivation of a formula or similar theoretical point. The first part deals with electrical units and descriptions of the various measuring instruments and adjuncts used in telegraph work. The second part deals with the simple measurements of resistance, E.M.F., current, battery particulars and condensers. The third part is devoted to the measurements on land and submarine cables during manufacture and during laying. Part IV deals with magnetic measurements, such as the flux of permanent magnets, self and mutual inductance, &c., and Part V with special alternating-current tests such as curve shapes, high frequency measurements, alternating-current resistance, &c. The index should be considerably enlarged, as there is necessarily more or less overlapping throughout the book, and it is not easy without a good index to decide in which part a particular test is likely to appear.

Die Selbsttätige Regulierung der Elektrischen Generatoren. By Dr. F. Natalis. Brunswick: F. Vieweg & Sohn. Price M. 4.—The question of the regulation of generator voltages by some method superior to hand regulation, and yet not involving special generator design and not excluding the possibility of hand regulation when desired, has been much to the fore recently, and the good results attained, notably by the Tirrill regulator, have raised great expectations. In this eleventh volume of "Elektrotechnik in Einzel-Darstellungen," Dr. Natalis discusses the whole subject in some detail. He distinguishes broadly between "low-speed regulators," such as those in which a reversible motor automatically moves the field regulator switch one way or the other and in which the whole regulation range is only completed in from 30 to 60 seconds, and "high speed regulators," such as the Tirrill type, in which the whole range is covered in a fraction of a second. The subject of the compounding of dynamos and alternators does not come within the scope of the book. Something like half the book is given up to the low-speed regulators, although these are of little practical importance, and the author admits that they can only be employed in stations where the load varies regularly and slowly—in which cases hand regulation is almost invariably preferred. The chapters on the Tirrill regulator and on a corresponding design due to the Siemens-Schuckert Werke are thoroughly clear and up to date, however, and contain not only a detailed description of the method of operation, but also a critical discussion of the limitations introduced by the various mechanical and electrical quantities involved and a consideration of the application of the regulators to direct and alternating-current central stations with a number of generators in parallel. The treatment is largely non-mathematical, and actual numerical values are introduced whenever possible.

Oeuvres de Pierre Curie. Paris: Gauthier-Villars. 1908. Price 22 fr.—For this collection of the works of M. Curie, that great *savant* who was cut off in the prime of his life and activity by a remorseless Fate, we are indebted to the pains of the Société Française de Physique. An excellent photogravure of the author is given as frontispiece, and the introductory article is from the hand of his widow, the equally distinguished Madame Curie, who shared in his scientific work. This preface takes the form of a brief biographical sketch; Mme. Curie describes the difficulties under which his research work was carried out in the early days at the Ecole de Physique, where he had not even a private room. Later, he obtained the use of a workshop, in which he and his wife began the researches on radioactivity which were destined to make their name and fame imperishable. The chemical processes which could not be carried on here were conducted in a dilapidated shed, without any of the usual apparatus; and it was in this leaky, draughty place that the best and happiest hours of the Curies' existence were passed. They could not lock up their radiant products, so had to leave them on boards and tables, and Mme. Curie recalls the rapture with which, when they entered the place one night, they saw on all sides the outlines of these samples, rendered visible by the luminosity of the mysterious substance which they sought to isolate. It was not, indeed, until almost the close of his life, after he became a professor in the Faculty of Sciences of Paris, that Curie obtained an adequate laboratory; like Faraday, he made his wonderful discoveries with the rudest apparatus, and in much less congenial surroundings. The works recorded in this volume begin in 1880, and continue until 1906, the year of his death. M. Curie's researches covered a wide field, but in particular piezoelectricity, crystallography, magnetism, and radioactivity were his chief interests. He was not fond of publicity; like Newton, he cared little whether he published his results or not; and he refused decoration. This volume will be found, like the radium which he and Mme. Curie extracted in minute quantities from a mountain of crude matter, the essence of a life work which in the case of many men less gifted, and less modest, would have filled a library.

"The *Mechanical World* Pocket Diary and Year Book for 1909." Manchester: Emmott & Co., Ltd. Price 6d. net.

"Science Abstracts." Sections A and B. November 25th, 1908. Vol. 11, Part 11. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each part.

Messrs. Harper & Bros. announce the publication of "How to understand Electrical Work." By W. H. Onken and J. B. Baker. A book for boys. 6s.

Condensing Plant Contracts.—The Mirrlees Watson Co., Ltd., have recently received orders for a number of condensing plants, among which are the following:—

Rio Tinto Co., Ltd., London.—Surface plant.
Aktiebolaget de Lavals Angturbin, Stockholm.—Surface plant.
Cie Française Thomson-Houston, Paris.—Surface plant for Tunis, repeat order.
James Howden & Co., Ltd., Glasgow.—Surface plant.

Catalogues and Lists.—Mr. G. Wuthrich, Norfolk Street, W.C. (Maschinenfabrik Oerlikon).—Tabular price lists of three-phase squirrel cage induction motors, one giving particulars of sizes from ½ to 8½ H.P., the other covering those of from 12 to 85 H.P.

The Harper Electric Co., 25, Southwark Bridge Road, S.E.—Small 8-pp. catalogue particularising and illustrating the firm's "Luxectric" signs which they are just placing upon the market for advertising purposes.

The Gilbert Arc Lamp Co., Ltd., Chingford.—Neat hanging show-card whereon are arranged illustrations of half-a-dozen of their designs of arc lamps, prices of several sizes being set out below the pictures. Electrical contractors can have copies of this card on application.

Messrs. H. T. Boothroyd, Ltd., Bootle, Liverpool.—Circular fully describing, illustrating, and stating prices of, the Woolliscroft safety enclosed liquid starting resistances and switches.

British Insulated and Helsby Cables, Ltd., Prescot.—Leaflet No. L. 31 briefly describing their portable safety hand lamp for colliery and other like service.

Indestructible Cable Co., Park Street, Southwark, S.E.—Leaflets relating to their vulcanised wires and cables, one giving special quotations for 600 and 2,500 meg. grades respectively.

Messrs. Johnson & Phillips, Ltd., Charlton, Kent.—Leaflet "S" dealing with various patterns of shades for incandescent lamps;

also "W" describing luminous electric radiators, electric kettles and cooking apparatus. Prices are tabulated in both lists.

Messrs. Newtons, Ltd., Taunton.—Illustrated circular giving some general particulars, also a table of prices and shipping weights and measurements, of the "Newton" paraffin engine and dynamo sets of which the firm are making a speciality, particularly for country house lighting installation work in conjunction with metal-filament lamps. Copies of the list can be obtained on application.

Messrs. Mansfield & Sons, Ltd., Derby Square, James Street, Liverpool.—It is surely carrying the war into the enemy's camp to ask an electrical journal to acknowledge the receipt of a pamphlet relating to the merits of oil gas lighting, but the fact is that the list is so bright and attractive and so artistically produced that your first impression is that it is a perfect piece of electricity supply publicity literature, so artistic is its design and arrangement, and so choice in its execution with neat cuts and effectively coloured interior views. For all the world some of these pictures resemble the effects of up-to-date electrical illumination; it is only when one reads that one discovers that it relates to the Mansfield system of lighting and power by oil gas. Of the system itself we need say nothing, but we have no doubt this pamphlet on "On Lighting" would interest any electrical man who wants to see what is claimed for it.

Dissolutions and Liquidations. — Amalgamated Radio-Telegraph Co., Ltd.—This company is winding up voluntarily, it having been proved that by reason of its liabilities it cannot continue business. Messrs. F. W. Pixley and H. Allen are liquidators. A meeting of creditors was to be held yesterday (Thursday).

T. Aken & Co., electricians and ironmongers, Hackney, N.—Messrs. T. Aken and W. Kort have dissolved partnership. The business will be discontinued.

Platinum.—The *Financial Times* has a lengthy report on the affairs of the Anglo-Russian Platinum Mining Co., Ltd. The properties of this company consist of a number of more or less scattered concessions on the rivers Irma, Iss and Viri, which have been found somewhat difficult to work. Disposal of certain of these properties is decided on. The Platinum Corporation, which is the parent company, owns shares in the Precious Metals Syndicate, a corporation possessing the option of a lease of a well-known property in the Urals. It seems probable that this company may have more influence on the market, provided that the concession be taken up.

Bankruptcy Proceedings.—Wm. J. Aubert, gas and electrical engineer, lately 16, Harp Alley, St. Bride Street, E.C., present address unknown.—A receiving order was granted on November 24th on a creditor's petition. The first meeting is to be held at Carey Street on December 8th, and the public examination on January 20th.

Thomas Ward, of 22, Totteridge Road, Enfield Wash, lately a director of the Electrical Instrument Manufacturers, Ltd., of Waltham Cross. The debtor attended at the Edmonton Bankruptcy Court on Monday to be examined with regard to his affairs, but the case was adjourned to the next Court. His statement of affairs shows liabilities amounting to £1,161, and no assets.

H. S. Marsh (lately trading as the Adjustable Cover and Boiler Block Co.), engineer, 21, New Road, Reading.—A receiving order was made on debtor's own petition at Reading on November 23rd.

R. S. Blackburn, electrical engineer and contractor, Hebden Bridge.—December 12th is the last day for receipt of proofs for intended dividend by C. H. Plant, official receiver, 13, Winckly Street, Prescot.

Trade Announcements.—From now until December 12th, Mr. David Alexander, of 43, Mains Street, Waterloo Street, Glasgow, is giving a special and very complete exhibition of "Igranic" electric motor-controlling apparatus supplied by the Adams Manufacturing Co., Ltd., for whom he is agent.

Messrs. H. & T. Danks (Netherton), Ltd., have opened offices at 22, Ely Place, Holborn Circus, E.C. Mr. J. A. Danks, who has been associated with the company for many years, and is a director, will be in charge of the department. We have received a copy of the firm's illustrated circular describing the "Sisson" patent superheater.

Mr. C. H. Dade, secretary, notifies us that the Electrical Traction and other companies constituting the British Electrical Federation, have removed from Donington House to Electrical Federation Offices, Kingsway, London, W.C., to which address all communications should now be directed. The names of the 59 different companies are given in the circular before us. All telegraphic addresses will remain as at present. The new telephone numbers will be 2,686 Holborn (private branch exchange).

Mr. W. Robb, electrical engineer, has opened business premises at 11, Drury Lane, Wakefield.

Electrical Installations, Ltd., of Bassishaw House, Basinghall Street, London, E.C., announce that to meet extended business, they have arranged for an additional exchange line, with extensions to all the various departments. Their numbers are now Central 13,894, and City 206.

The Klein Engineering Co. (1908), Ltd., with Mr. J. Duncan Crighton, as managing director, has been formed to carry on the condensing and cooling business of the late Klein Engineering Co., Ltd., and has taken over the existing registered offices at 94, Market Street, Manchester. The company will be represented in London as hitherto by Mr. F. Evill, at 51, Moorgate Street, E.C. The new company, having made special arrangements as regards works, will in future have all their specialities manufactured under their direct supervision.

LIGHTING and POWER NOTES.

Aberdeen.—Arrangements are being made by the Corporation for holding an electrical exhibition in February or March next. It will be illustrative of the modern uses of electricity.

The Royal Lunatic Asylum authorities are negotiating for an electrical supply. An agreement has been approved with the Admiralty for supplying the wireless station at Stoneywood.

Acton.—A special meeting of the Council has been held to consider the revised terms offered by the Metropolitan Electric Supply Co. to the Council, as a result of a conference between the two parties. The new terms offered by the company are as follows:—"In lieu of the method of charges provided for in the agreement, the company will, during the years 1909 and 1910, accept payment for all energy supplied at the rate of £5 per kw. per annum of the maximum demand in each year plus one-third of 1d. per unit, provided that—(1) electricity be again used for street lighting to the extent of not less than 110,000 units per annum; (2) proper sums be credited to the electricity department for any services rendered in connection with the sewage or other departments of the Council's works; and (3) the total payment to be made to the company be not less than £4,200 per annum. The secretary of the company stated that the previous reduction made by the company represented a saving to the Council which during the 12 months ended June 39th last amounted to about £650. The effect of the proposed further reduction would, it was estimated, increase the saving to about £1,000 on the basis of the current year's business, and this saving might, in the company's opinion, be greatly increased during the next two years if due advantage was taken by the Council of the modified terms. In the result the following motion was carried with two dissentients:—"That the further consideration of the Metropolitan Electric Supply Co.'s proposals be postponed, and that in the meantime the clerk be authorised and requested to enter into negotiations with the company on the following basis:—The company to take over the accessories and be responsible for the working expenses, repayment of loans, and all other expenses, for seven years, nevertheless subject to the subjoined provisions:—To charge no higher rate than the present charge, and when the scheme shows a net profit of 4 per cent., to charge ½d. per unit less on house and shop lighting, and to charge no more than 2d. per unit for street lighting."

Argentine.—The Cia. del Ferrocarril Bahia Blanca y Noroeste has been authorised to supply electric energy from its own works for lighting and power purposes in the town of Bahia Blanca. The company is granted rebate of duty up to 20,000 pesos for machinery and materials which it may be necessary to import for the extension of the works and the installation of apparatus, &c., in the town.—*Board of Trade Journal.*

Bolton.—According to an official report just issued by the Falcon Spinning Co., Ltd. (a new local concern), the shareholders are perfectly satisfied with the electrical equipment of their mill and its working.

Brighouse.—The T.C. on November 25th sealed an agreement with the Yorkshire Electric Power Co. for the purchase from the company of energy in bulk at 1½d. per unit. The agreement is for 14 years.

Brighton.—Mr. John Christie, manager of the electrical undertaking, reports having received from the Reason Manufacturing Co., a proposition which would enable the Council to test, without incurring any capital outlay, the value of the business of hiring out cooking, heating, and other similar apparatus. The company offers to provide and maintain suitable radiators at quarterly rentals of 4s. and 5s. respectively, according to the class of radiator selected, the Council simply to collect the money on the company's behalf. Mr. Christie considered the proposal an excellent one, and pointed out that any other manufacturers or contractors who came forward with a similar scheme would also receive the same treatment. The Electricity Committee has agreed to the proposal, and the engineer is to be authorised to make the necessary arrangements for the collection of the charges for the hire of the radiators.

Carlisle.—The T.C. has applied to the L.G.B. for a loan of £1,000 for the installation of plant for the storage and conveyance of coal at the electricity works.

Continental Notes.—Germany.—A new company has just been formed in Berlin with a capital of £1,500,000, and the title Die Elektro Treuhand Gesellschaft. The object of the concern, which is supported by the Allgemeine Electricitäts Gesellschaft, Messrs. Siemens & Halske and the Siemens-Schuckertwerke Gesellschaft, is to finance new electric installations, and to develop existing undertakings.

Bavaria.—The municipal authorities of Bayreuth have decided on the establishment of a central electric lighting station in the town, at an estimated cost of £15,000.

Dover.—The T.C. on November 24th sealed an agreement with the Admiralty for the supply of electricity for the harbour. By this, the Admiralty will pay for energy for lighting, so long as the maximum amount shall not exceed 100 kw., 2½d. per unit up to 200,000 units per annum; 2d. per unit for anything in excess of 200,000; the Admiralty guaranteering to pay for 75,000 units per

annum. For power the maximum is not to exceed 250 KW., and the price is 2¼d. per unit up to 200,000 units per annum; 2d. per unit for from 200,000 to 300,000; and 1¼d. per unit beyond.

Eccles.—The L.G.B. has given its consent to the Corporation borrowing the sum of £12,741 for works of extension at the borough electricity works in Cawdor Street, Patricroft. The various sums required are to be repaid in instalments within periods varying from 10 to 25 years.

Exeter.—The T.C. has decided for the present not to assist consumers to wire their premises for the electric light.

Goole.—The Board of Trade has revoked the 1901 E.L. Order.

Greystones.—At the quarterly meeting of the Wicklow County Council on Monday, the application of the Greystones Electric Light and Power Co., for permission to open streets and lay mains, &c., in the county, came up for further consideration. A deputation which was expected to appear did not present itself, and it was resolved, after some discussion, that a cash indemnity of £500 deposit be obtained, otherwise the application would be opposed.

Hanwell.—Notice appears in the *London Gazette* of December 1st of the proposed transfer by the Council, of the 1904 E.L. order to the Metropolitan Electric Supply Co., Ltd., for £585.

Holsworthy.—Application will be made to the B. of T. by Christy Bros. & Co., of Chelmsford, electrical engineers, to authorise them to generate and supply electrical energy for lighting, heating, power, and all other purposes, public and private, within the urban district.

Hounslow.—At the last meeting of the Urban District Council, it was moved that in view of the Local Government Board's inspector's remarks at the recent inquiry, the work in regard to the conversion of certain street gas lamps into electric lamps be postponed until after the inspector's report had been received. This was negatived. The tramway company is to be asked to push forward the new lines along the Bath, Staines and Hanworth Roads, and to consider the advisability of linking up St. Margaret's with Richmond.

Hull.—A L.G.B. inquiry was held by Mr. H. R. Hooper in respect of the application of the Corporation for permission to borrow the sum of £24,000 for the purposes of the electricity undertaking.

The electrical engineer explained the growth of the undertaking, and stated that the demand had gone eastward, and the necessity had arisen for a new sub-station on the eastern side of the River Hull. The various items of expenditure included a sum for the erection of a new sub-station, which had been completed by the city engineer. The Inspector asked if the work had been let out to tender, and the engineer replied that it had not; the city engineer had built one before, and the Committee thought it would be better if the engineer were entrusted with this special kind of building.

The inspector, commenting on this fact, pointed out that there was a structure that there was no estimate for and no tenders for, and he was told that it was some special work, which it was felt could not be done by anybody else, while at the same time there was a building of a similar character being put up by Messrs. Blundell, Spence & Co., a firm in the city. He confessed that it was in his mind difficult to reconcile the two positions.

The chairman of the Electric Lighting Committee said they gave the order for the building to their engineer because it was a question of pushing on the work to get it done as quickly as possible.

The electrical engineer pointed out that there would be the delay in advertising for tenders, but the Inspector, in reply to this, said that it would not take long.

Councillor Bower entered a strong protest against the manner in which the Committee had proceeded, and pointed out that there was a standing order that nothing over £50 should be done without tendering. They had, he said, done similar things on other Committees, but he did not know that the procedure was being adopted by the Electricity Committee.

The Inspector considered that certain of the items might be paid out of the Corporation's natural expansion loan, and the application was accordingly reduced to £11,000. The inquiry was then closed.

India.—Arrangements have been made for beginning work on the Simla hydro-electric scheme, and it is hoped to have 700 HP. of plant in that station early in 1911. The remaining 1,300 HP., for which the scheme provides, will be supplied when the demand for it arises. The site is some 14 miles from Simla, where the Nautikhud stream will be taken by a 6 by 3 ft. flume, 12,000 ft. long, into a tunnel 1,000 ft. long, and thence by a 550-foot drop into the Sutlej River, where the turbines will be placed. The power will be conducted to the new catchment area below Fogoo, where it will be used, in the first instance, for pumping water into Simla, the balance being carried into the station for lighting purposes.—*Board of Trade Journal.*

London.—L.C.C.—The Parliamentary Committee has been considering the proceedings of the Select Committee of the House of Commons on the London Electric Supply Bill (1908), and criticises the instruction in regard to the purchase by the L.C.C. of the various undertakings in London. It has decided that every endeavour shall be made during the progress of the Bill to secure the following amendments:—

1. That the undertakings of the companies shall be purchasable under the provisions of Sec. 2 of the Electric Lighting Act, 1888, except in the case of the undertaking of the Charing Cross Co. within the area of the City of London.
2. That, in the case of this last-mentioned undertaking, it shall be purchasable on Electric Lighting Act terms, plus a consideration in respect of the loss which the company may sustain by reason of purchase taking place in 1931 instead of 1941.
3. That an enabling power for the Council to advance capital to the companies after notice of purchase has been given shall be substituted for the obligatory power now in the Bill.
4. That the Council should be entitled to discharge three-fourths and not merely one-half of the purchase money by the issue of stock.
5. That the Council and the local authorities may be empowered to agree as to the purchase by such local authorities from the Council of so much of the distributing systems of the undertakings purchased by the Council as may be within their districts.
6. That the usual powers for the Council with regard to street works be inserted in the Bill.

Manchester.—The London and North-Western Railway Co. has introduced a system of electric signalling at its London Road Station, Manchester.

Peterborough.—The T.C. has decided to appeal against the assessment of the electricity works, which has been increased from £800 to £1,150.

South Stoneham.—The R.D.C. has definitely decided to consent to the application of the Southampton T.C. for an electric light prov. order to enable it to supply electricity to North and South Stoneham, subject to an option of purchase being given to the R.D.C. if the latter body ever decides to provide a separate supply.

Watford.—At a meeting of the U.D.C. held on Tuesday, the Council decided that application be made to the L.G.B. for sanction to borrow the sum of £4,952, to be made up as follows:—500 KW. turbo-alternator, complete with condenser and piping, £3,366; contingencies, £200; switchboard panel, £86; economiser, £402; pipe work and hot-water meter, £200; buildings, including for lines and foundations, £460; contingencies, £50; and for an engine, £188.

Wembly.—The North Metropolitan Electrical Power Distribution Co. has decided to proceed with work at an early date under the Wembly Electricity Order.

TRAMWAY and RAILWAY NOTES.

Bacup.—The town clerk reports that the purchase of the Bacup Tramways has been completed. The Rawtenstall authorities will act as contractors and construct the tramways. Recently it was resolved that thermit joints be used, and that Mr. C. D. Taite supervise the construction of the overhead equipment. Letters were read notifying the sanction of the L.G.B. to the borrowing by the Rawtenstall Corporation of £33,800 for the purpose of an electricity station, from which a supply of electricity in bulk will be given to Bacup. The consumption on the tramways is to be taken into account in fixing the price; the period of agreement to be the period of lease, with opportunities for revision at the end of each five years.

Belfast.—At the weekly meeting of the Tramways and Electrical Committee, on the 30th ult., Mr. Nance, the tramway manager, reported that he had been in communication with the Municipal Tramways Association with regard to the surcharges recently made by the L.G.B., respecting the payments of the expenses of delegates to the meetings of that Association. The organisation had taken the matter up, and had received a letter from the L.G.B., in which it was pointed out that the surcharges in question would be remitted, but that at the same time, there was no statutory enactment which authorised payments such as these from the rates, that Belfast was the only place in Ireland where tramways were owned by the municipality, and that if the Corporation wished to defray such expenditure out of the rates it must seek legislative authority. The manager added that the Association still had the subject under its consideration. At the meeting the tenders for a supply of trolley wire were submitted, and that of the British Insulated and Helsby Cables, Ltd., was accepted.

Bolton.—The T.C. has decided to seek powers to construct five additional lines of electric tramways in the borough.

Bradford.—The Tramways Department has installed a new system of electrical signalling to facilitate the working of traffic on single lines, which is likely to supersede the staff system of working generally in use on similar sections during foggy weather. The apparatus was recently inspected by Major Pringle of the B. of T., who has reported on the arrangement to the Board, and the Corporation has since received consent to equip as many sections as it thinks desirable with the arrangement. The peculiar novelty of the apparatus is (1) its extreme simplicity, and secondly,

the adherence to a well-known railway signalling principle, that in the event of the failure of the signalling apparatus the result is the blocking of the line rather than the opening. The general principle of operation is that of lighting and extinguishing electric lamps through the medium of a relay.

Canary Islands.—The steam tramway at Las Palmas has been sold to a Spanish Bank. The new proprietors, it appears, intend to employ electric traction, and for this purpose it will be necessary to erect a power house, to reconstruct the roadway, and to purchase new rolling stock adapted to the new system of traction. It is, moreover, intended to extend the line to the town of Santa Brigita (5,000 inhabitants), situated in the mountains nine miles to the south-west of Las Palmas. The length of the present line is about four miles.—*Board of Trade Journal.*

Cheshire.—A scheme has been mooted, and will shortly be submitted to the various local authorities concerned, for linking up those two fast developing communities on the Mersey—Birkenhead and Wallasey. The object of the promoters is to establish direct electric railway communication between Birkenhead and New Brighton in the first instance, and to proceed later by including Leasowe, Hoylake, West Kirby, and other centres of the Wirral Peninsula. This district is tapped by the Mersey (Electric) Railway, the Wirral Railway, the Great Central and other lines, while there are somewhat extensive tramway systems in Birkenhead and Wallasey, which, although in close proximity to one another, are nevertheless not joined up in any way. The prime mover in the undertaking is Mr. Hickman, of New Brighton, and plans have already been prepared by Messrs. Pearce and Lloyd, of North John Street, Liverpool.

Continental Notes.—Germany.—The lack of co-ordination which has characterised the construction of underground electric railways in London without any physical connections finds its counterpart in Berlin at the present time, at all events from the point of view of the various schemes. For instance, the municipal project for an underground line at Wilmersdorf is still in an initial stage, the Berlin municipal line from the north to the south remains under consideration, the Schoneberg scheme is in a preliminary condition of construction in consequence of delay in the sanctioning of the necessary loan, the proposed suspended railway is partly put off, and the authorised eastern section of the old Underground Railway Co. is still in course of preparation. No systematic junction of any of these lines, where such would be possible, is in contemplation, and to them has now to be added a project submitted to the municipal authorities by the Allgemeine Co. for the construction of an underground and elevated railway from Gesundbrunnen to Kottbusertor.

Spain.—The Soc. An. de Tramway de Madrid and d'Espague of Paris and Madrid has obtained the concession for the tramway from the Gloriete de Alonso Martinez to Chámartin de la Rosa.

Crewkerne-Martock.—The Yeovil R.D.C. has decided to apply to the Light Railway Commissioners for power to advance, by way of loan or investment, if thought desirable, a sum not exceeding £3,000 to the promoters of the Crewkerne, South Petherton, and Martock Light Railway.

Euston-Watford Electric Railway.—At a meeting of the Watford U.D.C. on Tuesday evening a letter was read from the L. and N.W. Railway Co., stating that the work of the new electric railway from Euston to Watford was about to commence, but no date as to when the work would be completed could be given.

Folkestone.—The local tramway company has notified its intention of applying for a Bill to authorise the use of the overhead trolley system, instead of the Dolter surface contact system as originally proposed.

Glasgow.—The report of the deputation which attended the congress of the International Tramways Union at Munich in September last has been submitted. Among other things, it is suggested that air brakes should be tried on the Glasgow cars, and that the matter of screening the driver from the weather should be further inquired into. With the system of transfer tickets in use in Munich, they disagreed.

The process of linking up the Glasgow Corporation and the Dumbarton tramways has now been completed, except for the canal bridge, which is the only break in the long run from the city to Loch Lomond.

Heston and Isleworth.—At the last sitting of the U.D.C., on motion of Mr. Emmett, it was decided to call upon the London United Tramways to proceed with the line from Hounslow to Staines, authorised by Act four years ago, and the line from Hounslow to Hanworth, which was sanctioned as a light railway at the same time.

Liverpool.—The B. of T. has sanctioned the proposed borrowing of £12,400 for tramway extensions.

London.—In connection with the proposed Victoria-Cricklewood tube, it is intended to abandon the section between Victoria and Edgware Road Station of the "Bakerloo," and to continue the latter line to Cricklewood, some 3½ miles further. The new line will be owned by the North-West London Railway Co., but will be worked by the "Bakerloo" Railway. Six stations are proposed on the new section.

Since the fire on the City and South London Railway in June last, the L.C.C. has been considering the need for additional precautions on all tube railways, and recommends that incombustible platforms should be provided, and that these railways should be periodically inspected by the chief officer of the Fire Brigade. It is also recommended that there should be provided automatic signal lights, or preferably an illuminated sign, which will show on the platforms of the stations, and also on the street level, when the current to the live rail is cut off in either direction.

The Central London Railway has introduced an accelerated service of trains, with two-minute intervals during the day and three-minute intervals at night. This has been rendered possible owing to the loop extension of the company's line to Wood Lane, which facilitates operations.

On Saturday last the Electrobus Co. tried a new type of vehicle, fitted with a covered top, on the London streets. The 'bus seats 18 inside and 18 outside; the new top cover adds but little to the weight, and, it is stated, does not affect the stability of the vehicle, owing to the heavy batteries carried under the chassis.

L.C.C.—All outstanding matters between the B.C. and the County Council with respect to the proposed widening and paving works in connection with the reconstruction of the tramways in Wandsworth Road and East Hill are now practically settled. Negotiations with regard to other lines are proceeding.

Stepney.—In a long report as to the proposed electrification of the trams between Aldgate and Bow, the Works Committee of the B.C. deny that it is impossible to use the conduit system. The borough engineer has prepared plans and sections showing the practicability of the system. Whilst the B.C. deplores the non-success and the great financial loss to the ratepayers involved in the experiments of the L.C.C., it trusts that it may yet be possible to make the "G.B.' surface contact system a success, so that shopkeepers and residents of the borough may not be subjected to further inconvenience and loss which would be involved in another breaking up of the highways. A copy of this report is to be sent to the B. of T.

Lowestoft.—The manager of the tramways has reported to the Borough Council that the traffic receipts for the year ending September 30th amounted to £11,033, as against £10,937 for 1907, an increase of £96.

Manchester.—The Corporation has given notice that in a Bill to be promoted next session, Parliamentary powers will be sought "to provide, run, and work cars, omnibuses and vehicles (with or without trailers) for the conveyance of passengers, goods, and other traffic along public streets and roads, without rails, by electric motors obtaining their energy from a generating station by means of overhead trolley lines," on the system known as the trackless trolley system. The Manchester Tramways Act, 1900, will be enlarged so as to embrace this system. It is intended to apply it to suburban roads, and one of the principal routes (for which already tramway powers exist) is that connecting Sale and Palatine Road (Withington) by way of Northenden. In the same intended Bill the Corporation is seeking powers to make various local extensions of tramway lines within the city.

New South Wales.—The report of the Commissioner of the New South Wales Government Railways and Tramways for the quarter ending September 30th shows a revenue from tramways amounting to £248,504, an increase of £20,014. The expenditure amounted to £192,806, an increase of £4,852.

Newcastle-on-Tyne.—The question of the financial position of the tramways has been much canvassed of late, and at a meeting of the Tramways Committee on November 26th, when Sir Joseph Baxter Ellis was re-elected chairman, he took the opportunity to refer to the question at some length. He said that the tramway system was never in a better or more satisfactory position than now, when they took into consideration the disadvantages with which they started the year, the concessions in workmen's fares, lengthened stages, and the reduction of fares. These concessions were expected to cost about £9,000 to £11,000. Unfortunately, they experienced a strike lasting 32 weeks, which reduced their income by £300 or £400 per week. Still, in spite of all that, their position was that their capital total expenditure was £1,166,785 to September 30th, 1908, with £7,960 for Parliamentary expenses; they had repaid in loans and paid in instalments to the sinking fund £201,680, in addition to paying interest on capital; they had also laid on one side for reserve and renewals investments totalling £65,650, and a further sum of £10,000 sanctioned for investment a month ago. Out of this they had paid for renewals at the pumping station, the new storage battery, and the relaying of the lines in Westgate Hill, leaving them with a net amount of £71,846. The renewal of the Westgate Hill track cost them £607, but they got £113 for old rails, leaving the net cost for 500 lineal yards of track, £494. At that cost, supposing that the whole of the 60 miles of track in Newcastle had to be relaid—and there was no fear of such a calamity—they would require £104,280. But, with the exception of some of the curves and gradients, the lines would last their time. In the last half-year they had made £7,361 net profit.

Rochdale.—A deputation representing the local Tramway Committee has interviewed the Electricity Sub-committee with regard to a reduction in the charges for energy for the tramways. The Electricity Sub-committee has decided not to reduce the price, but has agreed to forego the £236 which the Tramways Committee pays to the department for establishment charges.

Salford.—The Tramways Committee has recommended that application be made to the B. of T. for sanction to borrow £2,490 to meet the expenditure proposed on an impregnating plant, an automatic sprinkler installation, &c., for the central car depôt.

Twickenham.—Sir Clifton Robinson has replied in detail to the complaints made as to the tramcars. He denies that there is any overcrowding, or that the services of workmen's cars are inadequate, and he adds that the car services are based strictly on time schedules, and that any unpunctuality was due to causes such as municipal street works, over which, of course, the company had no control. In conclusion, he expresses the opinion that "many of the criticisms were the outcome of complaints based upon a blend of insufficient knowledge and prejudice, stimulated occasionally by the assumption that the company are not cognisant with the elementary principles of their own business."

U.S.A.—An early morning New York street car containing 65 people, returning from a ball, was recently held up by four men, in Third Avenue. Both driver and conductor were covered by revolvers, and while the passengers were relieved of their valuables, the car was rapidly driven to a point suitable for the escape of the intruders, who have not been traced. The police were aware of what was occurring in the car, but owing to its speed were powerless to interfere.

San Francisco.—Before the earthquake and fire of 1905, of the 288 miles of single track, 77 miles were operated by cable, horse traction was on five miles, and steam on one mile. Now the whole of the city has been equipped with overhead electric traction.

TELEGRAPH and TELEPHONE NOTES.

Assessment of Telephone Earnings.—The National Telephone Co. has withdrawn its appeal against the assessment of its lines made by the Chorlton Union under the new valuation, which takes into account the earnings of the lines, as in the case of railway and tramway lines. The assessment was advanced from £2,895 to £4,491, and next year will advance to over £5,000. The old system was to assess the lines at the rate of £1 per mile. In Chorlton alone, which is one of 660 unions, the difference to the company in the amount of annual rates paid will be £1,000.

Australia.—The *Times* reports that the Commonwealth Government has just taken an important step in the direction of the encouragement of electrical manufacturing in the Colony. Instructions have been given by the Postmaster-General that Australian firms be invited to tender for 10,000 wall telephones, together with the associated electrical parts. It is also stated that it is possible that the order may be extended to 30,000 telephones, spread over a term of years, if by that means it is possible to establish this new branch of industry. A former invitation to tender for 5,000 telephones and parts of Australian manufacture failed to receive any response as respects the parts, while only two tenders were received for the instruments, which were 150 per cent. higher in price than the imported apparatus.

Cheap Telegrams.—On December 1st the French Post Office authorities made an important innovation in the shape of second-class telegrams, to be sent over the wires during the slack periods of the night. The tariff for the proposed telegram-letters is one centime per word, or ten words a penny. They will be accepted for transmission after nine o'clock at night, and will be delivered at their destination by the postmen with the first delivery of letters on the following morning. For the present the system will be tried in those towns where there is an all-night telegraph service, but it will be extended if the public accord it a welcome. This means of utilising the expensive plant of the telegraph system during the unoccupied hours should show a profit if managed economically.

L.C.C. New Fire Alarms.—The L.C.C. has adopted a new type of apparatus, which, according to the *Daily Telegraph*, has the following advantages over that now in use:—(*a*) When the fire-alarm is pulled, all the electric bells throughout the fire-station are actuated, instead of only the bell in the watch room, as at present; (*b*) when there is a fault on a fire-alarm circuit only one bell in the watch room of the station rings; and any small defect on a circuit is immediately indicated; (*c*) the person calling the brigade by means of the fire-alarm can be rung up from the fire station, and telephonic communication can be kept up between the fire-alarm and the fire station, a receiver being kept in the fire-alarm post for the purpose. The experimental installation has proved satisfactory, and in view of the great advantages of the new apparatus the chief officer of the brigade recommends that it should be adopted for the fire-alarms connected with all stations, and for all new fire-alarm posts to be fixed in future. The existing fire-alarm system, which is considerably out of date, will be modernised and made as satisfactory as is at present possible. There are about 1,300 fire alarms in London, and from estimates supplied by the Post Office, who provide and maintain the whole of the apparatus for a yearly charge, it appears that the cost of adapting these would be about £3,500. In addition, the annual charge for fire-alarms would ultimately be increased by about £425, less £120 saved by the abolition of portable telephones.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Port Arthur-Chifu	.. Mar. 9, 1904 ..	..
Cotonou-Grand Bassam	.. Oct. 29, 1908 ..	..
Oran-Tangier	.. Nov. 22, 1908 ..	Nov. 25, 1908
Zanzibar-Mombasa	.. Nov. 24, 1908 ..	Nov. 26, 1908

Trinidad and Tobago.—The Colonial Report for 1907-8 gives particulars of the working of wireless telegraphy between these two islands. 240 private and 78 official telegrams were dispatched from Trinidad to Tobago, while Tobago sent to Trinidad 245 private and 64 official messages, making a grand total of 627 messages. Every opportunity to communicate with ships equipped with wireless apparatus was taken advantage of; there were 13 such communications during the year from the Trinidad station, and five from the Tobago station. H.M.S. *Scylla* communicated several times from Grenada, and once from St. Vincent (200 miles distant), and with Tobago, when she was 150 miles away. The Government internal telegraphs constructed by the Government comprised 85 miles. There is a complete system of telephonic communication in Port of Spain, which has been extended to the principal towns and out-stations. The service is worked by a company.

Wireless Telegraphy.—A Bill for putting in force the decisions of the Berlin wireless telegraphy, conference of November, 1906, as embodied in an international convention, has been laid before the French Chamber.

The Signal Corps of the United States Army has connected Nome with Seattle by means of wireless telegraphy, and the installations at Cape Nome, Fort Egbert, Fort Gibbon, Fairbanks and Circle City are said to be successful.—*Telegraph Age.*

According to the *Daily Mail*, a long-distance wireless station is to be built for the United States Navy Department, near Washington, to be capable of sending messages a distance of 3,000 miles. The present stations along the Atlantic coast will be abandoned after its construction. Two ships will also be fitted with equipments having a sending radius of 1,000 miles.

Iquitos, Masisea, Requena and other places in Peru may now be reached by wireless telegraphy from Puerto Bermudez, in the same country, but telegrams are only accepted at senders' risk.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdeen.—The electricity department invites tenders for materials. Schedules from J. A. Bell, engineer, Millburn Street.

Algeria.—January 15th. Tenders are invited by the Bône municipal authorities for—(1) the construction and working of a central electric power station, and (2) the construction and working of an electric tramway. Copies of the projects, specifications, &c. (in French), may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Australia. — Queensland. — January 4th and 11th, 1909. Tenders are required by the Postmaster-General for:—No. 1, telegraph instruments, accessories and spare parts; No. 2, telephone instruments, accessories and spare parts; No. 3, switchboards, accessories and spare parts; No. 4, measuring instruments, protectors, accumulators and parts. Tenders for the foregoing by January 11th, 1909; and for cables, copper wire, iron wire and insulators, by January 4th, 1909.

Melbourne.—December 15th. 33,200 incandescent lamps for the Council. See "Official Notices" November 27th.

Sydney, N.S.W.—April 28th, 1909. The Postmaster-General requires tenders for the supply, erection, &c., of a branching metallic multiple magneto switchboard at the William Street telephone exchange, according to specification No. 236.

Baku.—January 24th. The T.C. is inviting tenders for its electric tramway concession (42 years). Full particulars at the Russian Consulate in London.

Battersea.—December 22nd. Coal for the electricity department. See "Official Notices" to-day.

Belgium.—December 23rd. La Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels, is inviting tenders for the contract for the supply and erection of the overhead equipment, and the electric connections for the rails, of the light electric railway between La Louvière and Binche. Plans and specification can be obtained from the address given above after December 8th, at a cost of 1 fr.

Birmingham.—The Corporation Electricity Department will be glad to hear from firms capable of building large gas engines and producer gas plants. See "Official Notices" November 20th.

December 29th.—Electric motors for the Corporation Supply Department. See "Official Notices" to-day.

Bristol.—December 10th. The wiring of the Avonbank electric light station (third instalment) for the Electricity Committee. Specifications, two guineas (returnable as usual), from H. Faraday Proctor, city electrical engineer.

Canada.—Winnipeg.—December 28th. A *Financial Times* dispatch from Winnipeg says that the municipality on Nov. 24th resolved to invite tenders, to be delivered by December 28th, for extensive power plant, the cost of which is stated at more than £1,000,000.

Cardiff.—December 18th. One 2,500-K.V.A. turbo-alternator, complete with surface-condensing plant and motor-driven auxiliaries for the Corporation. See "Official Notices" to-day.

December 12th.—The Corporation is inviting tenders for 30,000 tons of coal for the electric lighting and tramways department. Tenders to J. L. Wheatley, Town Clerk.

Dover.—December 9th. Electrical sundries and electric cables for the Dover Harbour Board (2s. 6d. for schedule). Martyn Mowll, Register, Castle Street, Dover.

Edinburgh.—December 7th. Various stores, including electric light supplies, for the Edinburgh and District Tramways Co., Ltd. Forms of tender, 1s. per schedule, from offices, 1, South Charlotte Street, Edinburgh.

Felixstowe and Walton.—December 12th. Diesel oil engine and dynamo for the U.D.C. See "Official Notices" November 27th.

Germany.—Tenders are about to be invited by the municipal authorities of Bischofswerder, West Prussia, for the construction of an electric tramway in the town.

Glasgow.—Electric motor, cables, fuses, &c., for artificial milking installation at Woodilee Asylum. Mr. Robert Tannoch, master of works, Woodilee, Lenzie.

Hackney.—December 17th. D.C. electricity meters, of the ampere-hour motor type, for the electricity department. See "Official Notices" November 13th.

Manchester.—December 9th. Exhaust steam and other pipes for the Electricity Committee. See "Official Notices" November 27th.

Powell Duffryn Steam Coal Co., Ltd.—December 7th. Electrical goods. Stores Manager, Aberaman Offices, Aberdare.

Spain.—MADRID.—December 21st. The municipal authorities require tenders for the supply of electric lighting material and fittings for the service from January 1st, 1909, to December 31st, 1910. Samples may be seen at the Casa Consistoriale Ayuntamiento Constitucional.

Trimdon Grange (Co. Durham).—December 12th. Electric fittings for a year for Walter Scott, Ltd., Trimdon Grange Colliery. Storekeeper, Trimdon Grange Colliery.

Walthamstow.—Tenders are to be invited by the U.D.C. for a supply of cable for the period ending March 31st, 1910. 50 to 70-ton lots of various kinds of steam coal are to be ordered by the electrical engineer for testing purposes.

CLOSED.

Bolton.—The Electricity Committee of the T.C. has accepted the tenders of the Perfecta Steel Tube Conduit Co. and Messrs. Isaac Griffiths & Son, for tubes and fittings for a year.

Derby.—The T.C. E.L. Committee has decided to order a new water recorder from the Lea Recorder Co.

Glasgow.—The T.C.'s Hospital Committee has accepted the offer of Messrs. Allan Arthur & Ure, amounting to £87 10s., it being the lowest, for relaying the cables for the electric lighting of the grounds of Ruchill Hospital.

Leyton.—The quotation of the Underfeed Boiler Co. to fit the second Stirling boiler with a mechanical stoker, similar to the one already installed, has been accepted by the T.C., at £417. The company, have, however, made a contribution of £50 per boiler towards the cost of the mechanical stoker, so that the loan to be applied for will amount to £367. The electrical engineer reported, in connection with the matter, that for the 28 days from October 12th to November 8th inclusive, the mechanical stoker consumed 322·37 tons of slack at 10s. 11d. per ton. The equivalent consumption of hard coal at 16s. 5½d. per ton to do the same work would have been 281·09 tons, so that there was a saving of £55 7s. 1d., equal to £1 19s. 6d. per day. A certificate for the payment of that amount has been issued to the company.

London.—POPLAR.—The B.C. has received the following tenders for the supply of steam, feed, and blow-down piping in connection with the erection of the new boiler at the electricity works:—

L. Bas & Co. (accepted)	£303	J. Spencer & Co.	£357
Babcock & Wilcox	338	Wilson & Co.	389
Stewarts & Lloyds	£444.		

L.C.C.—The Stores Committee has accepted the tenders of the following for annual supplies:—

ELECTRIC FITTINGS, GLOBES AND SHADES.

Baxter & Caunter	£53	W. McGeoch & Co.	£25
G. Braulik	31	Nettlefold & Sons	Schedule of prices.
City Glass Co.	6		
Dorman & Smith	27	Siemens Bros. & Co.	40
Elliott Bros.	57	Smith Bros.	14
Falk, Stadelmann & Co.	14	G. Straus & Co.	16
General Electric Co.	50	Taylor & Co.	4
A. P. Lundberg & Sons	13	Veritys, Ltd.	7
W. White & Co.	£48		

ELECTRIC INSULATING MATERIALS.

Baxter & Caunter	£1
British Electrical & Manufacturing Co.	184
British Insulated & Helsby Cables, Ltd.	17
British Westinghouse Co.	7
W. Geipel & Co.	40
General Electric Co.	34
James North, Hardy & Son	169
D. Jaroslaw	7
Micanite & Insulators Co.	96
G. Schultz & Co.	276
Siemens Bros. & Co.	23
Taylor & Co.	12
A. Terry	176
Veritys, Ltd.	Schedule of prices.

ELECTRIC CABLES AND WIRES.

Callender's Cable & Construction Co.	£172
Hooper's Telegraph & India-Rubber Works, Ltd.	Schedule of prices.
Western Electric Co.	2,961

The Highways Committee has considered the following tenders for the roadwork and platelaying in connection with the reconstruction of the tramways from Prince of Wales Road to Archway Tavern, Highgate:—

J. Mowlem & Co. ..	(recom.) £31,223	Dick, Kerr & Co.	£31,498
	A. M. Coles	£33,128	

Salford.—The Electricity Committee has accepted the tender of Balcke & Co., at £12,344, for the supply and erection of water cooling plant at the electricity works, in lieu of a tender previously accepted. The tender of B. Thomas for the electric lighting of Seedley Baths, at £459, has been accepted.

The Tramways Committee has accepted the following tenders:—

A. G. Brown.—Impregnating plant, £75.
Hulse & Co.—Car-wheel lathe, £626.
Witter & Son.—Automatic sprinkler installation, £1,495.

Shipley.—The U.D.C. has accepted the tender of Electromotors, Ltd., Openshaw, for a 10-in. pump and motor, with switchgear, at £333.

Spain.—The Spanish Siemens-Schuckert Co. has obtained the contract for the electric lighting installation on the new cruiser *Reina Regenta*.

Walthamstow.—The U.D.C. has accepted the undermentioned tenders for arc lamp carbons for the period ending March 31st, 1910:—

Sloan Electrical Co.—Conradty carbons for 10-amp. lamps.
Geipel & Lange.—Conradty carbons for 5-amp. lamps, and ordinary carbons.
Siemens Bros., Ltd., and the Sloan Electrical Co.—Flame arc carbons.

Watford.—The following tenders have been accepted:—

Turbo-alternator.—British Thomson-Houston Co., £2,400.
Condensing plant.—Isaac Storey & Sons, £966.
Switchboard panel.—British Thomson-Houston Co., £86 10s.
Economiser No. 2.—E. Green & Sons, £402.
Fan engine.—Ashworth & Parker, Ltd. £188.
Building flues and foundations.—L. R. Ensor, £496.
Meters.—Ferranti, Ltd.

Wolstanton and Burslem.—The Board of Guardians has accepted the tender of the National Telephone Co. for alterations and additions to the telephones at the Workhouse, at £93 10s.

Zagazig.—The following list has been received of the tenders submitted for this installation. £E1 = £1 0s. 6d.

British Manufacturers' Syndicate (steam)	£3,874
Thomson-Houston (Diesel)	6,271
British Engineering Co. (steam)	4,441
Electric Light and Power Co. (steam)	7,750
Bogais et Cie. (steam)	4,854
Vienna Diesel Co.	7,000
Siemens Diesel Co.	7,438
Brush Co. (suction gas)	4,930
Maggiore (steam)	7,000
Lahmeyer (Diesel)	8,430
Société General (Diesel)	7,620
Do. (steam)	5,285
W. H. Allen, Son & Co. (steam)	4,270
Egyptian Engineering Co. (steam)	5,750

The Worries of the Station Engineer.—Consumer ringing up lighting station: Is that the engineer-in-charge?

Engineer-in-charge: Yes, who are you.

Consumer: I'm Mr. Brown; are you aware that the light over my desk is out?

Engineer-in-charge: Of course I am not; how could I be?

Consumer: Oh! I thought you had a meter at the station to tell you when and where a lamp went out.

The engineer regretted to inform him that they had not.

The above-mentioned lighting station was supplying about 300,000 lights at the time.

CONTRACTORS' COLUMN.

The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERFELDY.—Proposed new cottage hospital. Trustees, Aberfeldy Cottage Hospital.

ABERGAVENNY.—Additions to Monmouthshire Asylum. E. Johnson, architect, Abergavenny.

ALDERSHOT.—Two houses and motor garage, Grosvenor Road. Friend and Lloyd, architects, 45A, Grosvenor Road, Aldershot.

ALVERDISCOTT (DEVON).—Wesleyan chapel.

AMERSHAM.—Probable re-erection (after fire) of Copperkins House, Amersham Common, for John Hayes, Chesham.

ASHFORD.—Proposed County Technical Institute (£4,000).

BACKWORTH (NORTHUMBERLAND).—Colliery developments. Backworth Moor Colliery Co.

BACUP.—Proposed conversion of Mechanics' Institute into Public Offices. Surveyor, Corporation Offices, Bacup.

BAKEWELL.—New baths and pump-room for the U.D.C. W. R. Bryden, architect, 1, George Street, Buxton.

BANBURY.—Probable developments at Banbury Cross Mills. Wrench and Co., Shutford Plush Mills, near Banbury.

BARNSLEY.—Completion of St. Peter's Church (£5,000); Rev. T. J. Pickle, vicar of St. Peters. Houses, Westville Road, for T. H. Johnson; Allatt Street, for J. Reynolds. Wholesale shops, in the market, for the T.C.

BARNSTAPLE.—Wesleyan chapel at Newport, Barnstaple; A. Lauder, architect, Bridge Buildings, Barnstaple. Secondary schools; A. Lauder, architect, Bridge Buildings, Barnstaple.

BATH.—Additions to City Technical College (£8,000). A. M. Green, architect, 5, Princes Buildings, Bath.

BEAUMARIS (ANGLESEY).—Village Hall at Llangoed (£1,500).

BEDFORD.—Additions to workhouse. H. Young, architect, 35, Maitland Road, Bedford.

BELFAST.—Extension of the G.P.O.

BIRKENHEAD.—Additions to Welsh Independent Church. L. W. Williams, architect, 410, Park Road North, Birkenhead.

BIRMINGHAM.—Additional workshops at the Public Lighting Department, Park Street; H. E. Stilgoe, City Surveyor, Council House, Birmingham. Church building scheme in connection with Moseley Unitarian Church; Rev. T. Gorton.

BISHOP'S WALTHAM.—Proposed Church Hall.

BLACKBURN.—Alterations at Theatre Royal. Parkinson & Sons, Ltd., contractors, Blackpool.

BLACKPOOL.—Extension of Y.W.C.A. Holiday Home, South Shore. Installation of electric centrifugal pumps, North Shore, for the T.C. (£1,800). Houses, Portland Park Estate, for F. Ayre; Boscombe Road, for J. J. G. Hall; Bela Grove, for J. G. Pye; Rothsay Road, for B. Sutcliffe; Handsworth Road, for J. Fielding and Sons; Fairhurst Street, for F. Whiteside; Warley Road, for E. Crowther; Sherbourne Road, for J. Foster; Cumberland Avenue, for J. D. Lonsdale; Camden Road, for F. High; Bourneville Road and Whitegate Drive, for H. N. Rose; Whitegate Drive, Portland Park Estate, for G. F. Clarke; shops and house, Elizabeth and Caunce Streets, for F. Tomlinson; shops and houses, Central Drive and Bethesda Road, for E. Carmouche; two bungalows, Cumberland Avenue, for R. H. Bailey; additions to bakery, Threlfall Road, for the Lancashire Cash Bakery Co.

BLISWORTH.—School (£5,000). Brown & Mayor, architects, 80, Abington Street, Northampton.

BOLTON.—Additions to premises, Nelson Square, R. Hough; yarn shed, Gladstone Street, John Rostron, Ltd; additions to works in Bella Street, J. Aspinall & Co.; four houses in Bennet's Lane, Messrs. Pilling, contractors, Bolton.

BRADFORD.—Corporation flats at Longlands (£14,000); C. Booth & Son, contractors, Bradford. Three houses, Broad Lane, Laisterdyke; J. Cowgill, architect, 20, Pearl Assurance Buildings, Bradford.

BRAINTREE.—Extensions of waterworks buildings, and machinery, for the U.D.C. Percy Griffiths, engineer, 54, Parliament Street, Westminster, S.W.

BRAUNTON (DEVON).—Proposed E.L. and power installation at works at Knowle, for Jas. Dennis.

BRIGHOUSE.—New spinning mills for Wood & Sons, Ltd., Thornhill Briggs, Brighouse. Electricity storage station; surveyor, Corporation Offices, Brighouse.

BRIGHTON.—Reconstruction of the Albion Hotel; Clayton & Black, architects, 10, Prince Albert Street, Brighton; Lynn & Sons, builders, 31 and 32, Marlborough Street, Brighton. Boiler and engine house, 42, Robertson Road; F. C. Axtell, architect, 11, Prince Albert Street, Brighton. Flats, Centurion Road; E. W. Long, architect, 54, Old Steine. Alterations to 1 and 2, Montpelier Crescent; Denman & Matthews, architects, 27, Queen's Road, Brighton.

BRISTOL.—School, Alexandra Park (£9,000); Rodway & Denning, architects, 28, Baldwin Street, Bristol. School, Kingsdown (£7,500); W. Skinner, architect, Edinburgh Chambers, Bristol. St. Ambrose Church (£12,000); A. W. and V. Gough, architects, 23, Bridge Street, Bristol. School for the Blind (£14,000); E. Gabriel, architect, Orchard Street, Bristol.

BRITON FERRY (GLAM.).—Proposed public hall (site given by Evans Bevan). T. H. Hunter and W. H. Humphreys, joint secretaries.

BROADSTAIRS.—Additions to South Court, Ramsgate Road, for Miss Dowker; houses, York Avenue, for H. J. Hancock; Lindenthorpe Road, for R. W. Ruck.

BROMLEY.—Additions, The Spinney, Woodlands Road; C. H. B. Quennell, architect, 17, Victoria Street, S.W. Additions to Oak Cottage, Lake Avenue, for the Kinnaird Park Estate Co.

BRIDLINGTON.—Alterations to 9, Bridge Street, for F. E. Gray; Palmhouse, Quay Road, for the T.C. (£965 10s.); Messenger & Co., Ltd., builders, Loughborough.

BROMSGROVE.—Proposed Secondary School. Secretary, Local Education Committee, Bromsgrove.

BURNLEY (HAPTON).—Proposed new Elementary School (300 scholars). H. Littler, county architect, 16, Ribblesdale Place, Preston.

BURTON-ON-TRENT.—Roman Catholic Church Schools (£2,450); R. Kershaw and Sons, builders, Princess Street, Burton-on-Trent. Wesleyan Schools, High Bank Road, Winshill; H. Beck, architect, Burton-on-Trent.

BUXTON.—New Church Institute at Burbage.

CANTERBURY.—Six houses in Lancaster Road. F. T. Gentry, builder, 44, Broad Street, Canterbury.

CARDIFF.—New laundry premises, Cardiff Laundry Co.; E. W. M. Corbett, architect, Bute Estate Office, Castle Street, Cardiff. Co-operative wholesale premises, St. Mary Street; F. Harris, architect, Balloon Street, Manchester. New Welsh Calvinistic Methodist Chapel at Penylan.

CARSHALTON.—Twenty houses, Cranfield Road and Stanley Road, for A. B. Cook; house, Chalgrove Road, for R. Knight.

CASTLE DONNINGTON (DERBYSHIRE).—Proposed restoration of buildings, Rev. J. Farrar Stevens, vicar.

CHELMSFORD.—Extensive alterations to business premises, Springfield Road, for Collins & Son, glass and china dealers. Proposed Council School in Trinity Road. Villa, Hill Road, for F. Saunders; four houses, Anchor Street, for Beckett Bros.; villa, Rainsford End, for W. O. Miller; house, Springfield, for Mrs. Bolingbroke.

CHESTERFIELD (PILSLEY).—Extension of Pilsley Parish Church and the Church Institute.

CHICHESTER.—Renovation of the Guildhall, Priory Park (£500). E. S. Prior, architect, Chichester; Vick & Sons, builders, Chichester.

CHIPPENHAM.—Villas, Sheldon Road; H. C. Cook, builder, 2, Crofts Road, Swindon. Twelve houses, Ladyfield Estate, for Mr. Ashe. Shops and offices, The Bridge, for J. L. Foreman; P. B. Rigg, architect, Frome.

CHORLEY.—Thirty houses; Surveyor, Corporation Offices, Chorley. Houses, Weldbank Lane, for Wm. Hampson, builder, 81, Pall Mall; off Pilling Lane, for H. Martindale; Pennine Road, for S. Froom and Sons, builders, 18, Seymour Street.

COLWYN BAY.—New premises and hostel for the Y.M.C.A.; Wesleyan Methodist School; Church at Old Colwyn (£2,000).

COOKHAM.—Houses, Furze Platt, for Partlo Bros.; Highway Estate, for Miss Wilson; alterations and additions to Hurley House, Hurley, for Mr. Sargent; houses, Highway Estate, for R. Francis; Alwyn Road, for W. Wynch.

COWES.—Five houses, Tennyson Road, for H. E. Day, builder, Tennyson Road; stabling at Waestecroft, Park Road, for Baroness von Hillyer.

CROYDON.—Church hall, &c., in connection with St. Philip's Church, Norbury; E. G. Cole, architect. Extensions to the workhouse (£15,000).

DARWEN.—Council school in Sudell Road (£7,000). Lloyd & Millwood, builders, Darwen.

DEAL.—Eleven houses, Middle Deal Road and Church Path; A. W. Thompson, builder, Cambridge Place, Lower Walmer. Five houses, Albert Road; G. Jefford, builder, 1, Greenwood Terrace, South Wall Road.

DERBY.—Proposed improvements at girls' secondary school; Director of Education, Derby. Alterations to slaughter houses and Market Hall (£10,000); Borough Surveyor.

DONCASTER.—New Wesleyan Church at Brodsworth (£1,500). P. B. Houlton, architect, Chesterfield; Dennis Gill & Son, builders, 8, Nether Hall Road, Doncaster.

DUNDEE.—Store in Broughty Ferry Road, for Northern Agricultural Co., Ltd.; villas in Ancrum Road, Lochee, for D. Webster; warehouse in Neish Street, for Thomson Bros., Ltd.

DUNMOW.—Bacon factory. W. Douglas & Sons, Ltd., Douglas Wharf, Putney, S.W.

DURHAM.—Important additions to the technical schools (£5,479). J. W. White, builder, High Barnes Works, Sunderland.

EASTBOURNE.—Improvement of the pier entrance, including new kiosks, &c., lit by electricity (about £1,000).

ECCLES.—Proposed secondary school. Local Education Director.

ENFIELD.—Rebuilding Hop Poles (licensed house), Baker Street.

ESSEX.—Restoration and additions East Thorpe Church. Chancellor & Son, architects, 20, Finsbury Circus, E.C.

FAKENHAM.—Catholic Church. Rev. Father H. W. Gray, Catholic Mission Fakenham.

FARNWORTH.—Developments at Bridgewater Street Mills. Messrs. Porritts, manufacturers.

Suggested new school in Queen Street. H. Rostron, secretary, Local Education Committee.

FENTON.—Alterations and additions to the Crown Bakery, for J. Walters. E. Jones and Jackson, architects, 10, Albion Street, Hanley.

Sewage disposal works at Sideway, for the U.D.C. S. A. Goodall, surveyor to the Council, Town Hall, Fenton.

FLEETWOOD.—Important dock extensions for the Lancashire and Yorkshire Railway Co. (about £80,000).

GALWAY.—Fever Hospital for the Board of Guardians. A. Cowlishaw, architect, Brentwood, Salthill, Galway.

GLASGOW.—Public hall in Clarendon Street (£6,000 to £7,000). Board School, Mollinsburn School; Glasgow School Board. Extension to baths and washhouses, West Scotland Street, Kinning Park; Corporation. Tenement dwelling houses and shops, Dalmarnock Road; John Porter, house factor, 577, Dalmarnock Road, Glasgow. Tramway depôt at Newlandsfield; A. B. McDonald, surveyor to Glasgow Corporation.

GOSPORT.—New Church in connection with the Baptist Tabernacle.

GRAVESEND.—Six houses, Lennox Road, for E. Bishop; Bridgland & Clay, architects. Extension of concert hall for the Rector and Wardens of St. George's Church.

GRIMSBY.—Proposed new municipal offices (£16,000), or extension of the Town Hall (£20,000); borough engineer.

HANLEY.—New premises, Market Square, for M. Huntbach & Co., Ltd., drapers, Hanley.

HEAP BRIDGE (HEYWOOD).—New elementary school. Secretary, Heywood Education Committee.

HESTON AND ISLEWORTH.—Alterations Dockwell Smallpox Hospital. J. G. Carey, surveyor, U.D.C.

HEBDEN BRIDGE.—Machine shop, Victoria Road, for Hughes & Fawcett.

HIGH WYCOMBE.—Houses, Priory Avenue, for A. W. Nash; London Road, for Miss Taplin; Roberts Road, for Mr. King; additions to to chair factory, for J. Gibson, Frogmoor; additions to house, Rectory Avenue, for C. W. Wood; public hall, Corporation Street, for Davenport Vernon & Co., Ltd.

HITCHIN.—Important water works supply scheme (£4,923). J. Aird & Son, contractors, Lambeth, S.E.

HULL.—Rebuilding premises, Market Place, for the Charterhouse Trustees; Broderick, Lowther & Walker, architects, 77, Lowgate, Hull. Warehouse, Beverley Road, for Blundell, Spence & Co., Ltd.; warehouse, Walker Street, for G. Lodge; extensions, Stoneferry, for Reckitt & Sons, Ltd.; development of estate for building purposes by R. Foster.

ILFORD.—Rebuilding of business premises, High Street and Cleveland Road, for Mr. Gilderson; houses, Felbrigge Road, for A. C. Corbett (E. T. Dunn, architect, 20, Mansfield Road); Wards Road, for A. R. Kydd; 81, St. Mary's Road, for Silcock & Sons; Eton Road, for G. E. Holditch; Montrose Terrace, for G. L. Turner; Chadwell Avenue, for G. Chaplin; parish room and temporary church, Goodmayes Lane, P. K. Allen, architect; bread factory, Ley Street, for R. Henderson (F. G. Faunch, architect, 76, Cranbrook Road); lock-up shop, Goodmayes Road, for A. Wilde.

KETTERING.—Installation of electric light in the Workhouse kitchen (electric light for the whole building to be considered).

KIDDERMINSTER.—Stone Shed and Office in New Road, for Messrs. Greatwich. New secondary school; Secretary, Kidderminster Education Committee.

KILLUCAN.—National Schools at Castlejordan, Ballinabracky. T. F. M'Namara, architect, 50, Dawson Street, Dublin.

KIRBY MUXLOE (Leicester).—School. W. Brand, architect, 33, Bowling Green Street, Leicester.

KNARESBOROUGH.—Proposed new Council Offices (£3,000). F. Cartledge, surveyor to the Council, Knaresborough.

LANCASTER.—Dwelling house and shop in Sibsey Street, for E. Parkinson; three dwelling houses in Bowerham, C. Hodgson; Independent Methodist lecture hall and class-rooms, J. Parkinson, architect, Church Street, Lancaster; proposed technical or secondary school, Director of Education, Lancaster.

LANGHOLM.—New post office, corner of High and John Streets.

LEEK.—Electric power installation at works in Queen Street, for A. J. Worthington & Co., silk manufacturers.

LEICESTER.—Additions to Town Hall; F. Hames, architect, 14, Gray's Inn Square, W.C. School; A. E. & T. Sawday, architects, 6, Market Place, Leicester. Premises for Stamford, Spalding and Boston Bank; S. Harrison & Son, architects, 7, St. Martin's East, Leicester; Haskard, Rudkin & Beek, builders, Braunstone Gate, Leicester.

LINCOLN.—Extension of St. Nicholas' Church (£2,400). C. Hodgson Fowler, architect, Durham; H. S. & W. Close, builders, Lincoln.

LINCOLN (Metheringham).—New Wesleyan Methodist Church (£2,000).

LIVERPOOL (Seaforth).—Proposed alteration of Seafield House, for use as a lunatic asylum. Mr. Lancaster, architect to the West Derby (Liverpool) Board of Guardians.

LLANDUDNO (North Wales).—New church at West Shore. Important extensions at Holy Trinity Church; the Rev. H. R. Hughes, rector of Llandudno.

LLWYNYPIA.—Hospital. Evans & Williams, architects, Post Office Chambers, Pontypridd.

LONDON (Kennington, S.E.).—Shop at Vauxhall Station, for South-Western Railway, Waterloo Station, S.E.

(E.).—Additions at 15, Chandler Street, St. George-in-the-East. F. Hooper, architect, 12, Norfolk Street, Strand, W.C.

(East Ham, E.).—Alterations and additions to motor-'bus garage, Redcliffe Road; J. H. Ashby. Alterations to shops, Green Street; E. A. Hammerton, builder, 401, Green Street, Upton Park, E.

(Streatham, S.W.).—Twenty-five houses, Brookview Road; E. & A. Wates, builders, 85, Mitcham Lane, Streatham, S.W. Twenty-five houses in Wyatt Park Road and Daysbrook Road; Chapple and Utting, builders, 24, Wavertree Road, S.W.

(Holborn, W.C.).—Wesleyan Hall, Great Queen Street. Gordon and Gunton, architects, Finsbury House, Blomfield Street, E.C.

(Bermondsey, S.E.).—Curing house, Channel Row. W. J. Dixon, builder, 3, Blue Anchor Lane, S.E.

(Clapham Junction, S.W.).—Alteration to stalls, Theatre of Varieties, St. John's Hill. F. Matcham & Co., architects, 9, Warwick Court, W.C.

(Bow, E.).—Fire station at Glebe Road. W. E. Riley, superintendent architect to L.C.C., Spring Gardens, S.W.

(Chelsea, S.W.).—Additions to Beatrix dining rooms, Draycott Place. The Dining Room Committee.

(Hoxton, N.E.).—Extensions at Messrs. Stollwerck's factory, Nile Street. St. Pancras Iron Works Co., 171, Pancras Road, N.W.

(Bethnal Green, N.E.).—Erection of school at Morpeth Street. T. J. Bailey, Education architect, L.C.C. Offices, Victoria Embankment, W.C.

(St. Pancras, N.W.).—School at Camden Street (£14,000). T. J. Bailey, Education architect, L.C.C. Offices, Victoria Embankment, W.C.

(Lewisham, S.E.).—Music Hall at Rushey Green (seat 3,700). W. L. Griffiths, architect, 9, Portsmouth Street, Lincoln's Inn Fields, W.C.

(Herne Hill, S.E.).—Eight houses in Poplar Walk, for H. C. Morrell, 139, Auckland Hill, West Norwood, S.E.

(Leyton, N.E.).—Thirty-six houses (flats), and five shops, Lea Bridge Road; J. Dunn, architect, 1, John Street, St. James' Square, S.W. Extension of workshops at Reliance Works, Skeltons Lane; W. A. Finch, architect, 76, Finsbury Pavement, E.C.

(Wimbledon, S.W.).—Additions to "Holywell," Marryatt Road; Burges & Sons, builders, Wycliffe Road, Wimbledon, S.W. Pension, Woodside; R. A. Hinds, architect, Wood Nook, Wimbledon Hill, Wimbledon, S.W.

(Walthamstow, N.E.).—Thirty-one houses, Studley Road; S. W. Robinson, builder, 77, Orford Road, Walthamstow, N.E. Offices, Blackhorse Lane, for Peter Hooker, Ltd., Blackhorse Road, Walthamstow, N.E.

(Waterloo Place, S.W.).—Block of offices, &c., Thompson and Walford, architects, Leadenhall Buildings, E.C.; Patman and Fotheringham, Ltd., builders, 100, Theobald's Road, W.C.

(Muswell Hill, N.).—Alterations and additions, All Saints' Parish Hall, Durham Road, for the Trustees.

(Hornsey, N.).—Alterations and additions, Station Parade, Archway Road. Batty & Eckert, estate agents, 20, Grand Parade, Hornsey, N.

(Acton, W.).—New public offices. W. H. Raffles and J. B. Gridley, architects, 10, Gray's Inn Square, W.C.

(E.C.).—Billingsgate Market to be extended (£11,000).

(W.).—Additions to the Empire Theatre, Leicester Square; F. T. Verity, architect, 7, Sackville Street, W. Shop at Brompton Road, Knightsbridge; T. H. Watson, architect, 9, Conduit Street, W.

(Southwark, S.E.).—Temporary enlargement of sorting office (£1,100), to be followed by permanent enlargement. H.M. Office of Works, Storey's Gate, S.W.

MALVERN LINK (Worcestershire).—Elementary school in Somers Park Avenue. Pritchard & Pritchard, architects, Bank Buildings, Kidderminster.

MANCHESTER.—Baths and wash-houses in St. John Ward (£7,000). Armitage Street, Ardwick (£10,000), and Miles Platting (£10,000). New central premises in Peter Street, for Y.M.C.A. Woodhouse, Corbett & Dean, architects, 100, King Street, Manchester.

MERSTHAM (near Redhill, Surrey).—New Wesleyan Church (£1,600).

MIDDLETON (Lancs.).—Elementary school in Elm Street (600 scholars); E. Wood, architect, 78, Cross Street, Manchester. Proposed technical or secondary school. Secretary, Local Education Authority.

MILNTHORPE (Westmorland).—New Police Station for the Westmorland Standing Joint Committee. County Surveyor.

MORECAMBE.—Proposed secondary school. Secretary, Local Education Committee.

MURTON (Durham).—Proposed housing scheme. Co-operative Society.

NEATH.—Hotel, stables, &c., at Seven Sisters, for R. Evans Bevan. J. Cook Rees, architect, Parade Chambers, Neath.

NEWTON-LE-WILLOWS.—Proposed secondary school at Earlestown. Secretary, Earlestown Education Committee.

NORTHAMPTON.—School, Billing's Road (£20,000). H. Norman, architect, 4, Wood Hill, Northampton.

NOTTINGHAM.—Additions to Lunatic Asylum. Mr. Lewis, City architect, City Hall, Nottingham.

PAISLEY.—Reed and Heddle Factory, 32, High Street, for P. K. Millar and Sons.

PEASEDOWN ST. JOHN (Somerset).—School for Somerset County Council. F. Bird, architect, Midsomer Norton.

PENDLETON (Salford).—Alterations to Swan Hotel, Eccles New Road, Weaste Lane.

PLYMOUTH.—Probable re-erection, after fire, of business premises, Russell Street, for R. Atwill, ironmonger.

PONTARDAWE.—Sewerage and sewage disposal scheme for the R.D.C. (£14,000). J. Morgan & L. H. Bell, engineers, Pontardawe.

PONTYPRIDD.—Shop premises in Mill Street for W. Chesser; A. Ll. Thomas, Church Chambers, Pontypridd.

PORT TALBOT.—Masonic Temple at Forge Road, for the "Afan" Masonic Lodge. J. A. James and T. Gibb, joint architects, Port Talbot.

RAYLEIGH (Essex).—New school at Hadleigh. F. Whitmore, architect to the County Council, 17, Duke Street, Chelmsford.

READING.—Large extensions to Royal Berks. Hospital (£20,000); C. Smith and Son, architects, Friar Street, Reading. Suggested fever hospital for Caversham at Kidmore; Clerk to Caversham District Council, Caversham.

ROATH.—Banking premises for National Provincial Bank. W. H. D. Caple, architect, Church Street, Cardiff.

ROMILEY (near Stockport).—Shops and houses for the Compstall Co-operative Society. R. B. Preston, architect, 51, South King Street, Manchester.

ROTHERHAM.—Electric light to be installed in Treeton Parish Church; Rev. J. C. Blackmore, rector of Treeton. Proposed electric light installation at the workhouse, for the B.G.

ROYTON (Lancs.).—Additional store rooms. Shiloh Spinning Co.

RUGBY.—Houses, Harborough Magna, for Mr. Denyer; Newton, for W. H. Pratt; additions to Willoughby House, for Mrs. Cross.

ST. HELENS.—Engine house, &c., at Cropper's Hill Power Station, for the T.C. E. M. Hollingsworth, borough electrical engineer.

SALFORD.—Additions to dye works, Meadow Road, Broughton. Boys' department at Wellington Street School; Mr. Broadbent, architect, Manchester. Additions to St. James Hotel, St. James Street. Extensions at Gas Works; borough surveyor, Salford.

SEEDLEY (near Manchester).—Wesleyan schools extensions. Trustees, Pendleton Wesleyan Circuit.

SHEFFIELD.—New St. Oswald's Church. Vicar, St. Oswald's Parish.

SHOEBURYNESS.—Proposed new offices and fire station for the U.D.C., Mr. Harris, surveyor.

SHREWSBURY.—New elementary schools in Cobham (£6,838). Treasure and Son, Ltd., contractors, Shrewsbury.

SITTINGBOURNE.—Houses, Cowper Road, for R. High, builder, 1, Bayford Road.

SOUTHEND-ON-SEA.—New hippodrome; B. Crewe, architect, 75, Shaftesbury Avenue, W.C. Pavilion ward at the Sanitorium, for the T.C.; E. J. Elford, surveyor.

SOUTH SHIELDS.—Nine houses, Hepscott Terrace, for Geo. Thornton & Co.; J. H. Morton, architect, King Street, South Shields. Two houses, Stanhope Road, for G. Thornton & Co.; T. Young, architect, 50, King Street, South Shields.

STAFFORD.—Wesleyan mission hall, Rowley Street. C. W. D. Joynson, architect, Springhead, Wednesbury.

STAMFORD.—Administrative block at the Stamford, Rutland and General Infirmary (£2,250). H. F. Traylen, architect; Roberts Bros., builders, Stamford.

STANTON-UNDER-BARDON (Leicester).—School. Harding & Topott, architects, 15, Hotel Street, Leicester.

STILLOGLIN (Co. Dublin).—Prospective rebuilding, after fire, of the Asylum of St. John of God.

STOCKPORT.—Important extensions to works at Heaviley, for H. Faulder and Co., manufacturing confectioners. Jas. Jepson, architect, 35, Great Underbank, Stockport; Daniel Eadie & Co., Ltd., builders, Heaton Norris.

STOKE-ON-TRENT.—Houses, Richmond Street, J. Perry; York Street, Basford, S. Heath; conversion of premises into offices, Robinson, Leadbeater, Ltd.; additions to the Ashlands, Hartshill, H. B. Shirley; additions to 26, Sheppard Street, Mr. Leadbeater; 12 houses, Daintry Street, W. Bell. Proposed erection of miners' rescue station; Secretary, Staffordshire Education Committee, Stafford.

STRATFORD-UPON-AVON.—Public conveniences for the T.C. Roden Dixon, borough surveyor, Sheep Street, Stratford-upon-Avon.

SWANSEA.—Alterations, &c., at the Smithfield Arms, the London and North-Western Hotel and the Maltsters' Arms, Carmarthen Road. Buildings in Castle Street; Swansea Corporation.

TAMWORTH.—Church at Clifton Campville. W. D. Caroe, architect, 3, Great College Street, S.W.

TENDRING (Essex).—Cottage homes for the B.G. A. P. Butcher, architect Colchester.

THRAPSTON.—School for Bedfordshire C.C. J. T. Blackwell, architect, Parkstone Chambers, Gold Street, Kettering.

TIPTON.—Important sewerage works and machinery for the U.D.C. (£24,050).

TIPTREE (Essex).—Public elementary school. J. W. Start, architect, High Street, Colchester.

TOPSHAM (Devon).—New Wesleyan Methodist Sunday School. E. Holman, Topsham.

TREFRIW (North Wales).—Welsh Calvinistic Methodist Chapel. G. Dickens-Lewis, architect, Talbot Chambers, Shrewsbury.

TREORKY.—New Vestry for the Baptist Church. W. D. Morgan, architect, 174, Ystrad Road, Pentre, Glam.

TRURO.—Improvements at the Harbour. F. Parkin, town clerk, Truro.

TUNBRIDGE WELLS.—New premises facing the Common, for the Tunbridge Wells and County Club. C. Burns, architect, 53, Lincoln's Inn Fields, W.C.

TIVERTON.—Technical School. F. Bird, architect, Midsomer Norton.

TWICKENHAM.—Additions to 14, The Barons; Brewer, Smith & Brewer, architects, 11, The Green, Richmond. New bakehouse and dwelling house; Goadby Howard & Marrian, architects, Bank Chambers, London Road, Twickenham.

TYLDESLEY (near Manchester).—Alterations to property in Elliott Street, J. Bleakley; new sidings for L. & N.W. Railway Co.

UPTON (Worcestershire).—Proposed new buildings at the Kempsey Workhouse. J. Hill, Chairman of the R.D.C.

WALLINGTON (Surrey).—Houses, Woodcote Avenue, for A. J. Morris; London Road, for W. T. Willcocks; Longfield Avenue, for C. S. Mitchell; Furze Lane, Beddington, for J. T. Deakins; Hackbridge Road, for F. H. Claridge; London Road, for A. Boulter.

WALSALL.—New Wesleyan Church in Mellish Road.

WARRINGTON.—Alterations, Winwick Street, for the Warrington Co-operative Society, Ltd.; moulding shed, Dallam Lane, for Whyman's Foundry Co., Ltd.; alterations and additions, National School, Church Street, for the trustees.

WATERLOO (near Liverpool).—Proposed Technical or Secondary School. Secretary, Local Education Authority.

WATFORD.—Additions to laundry, Southsea Avenue; C. Brightman & Son, builders, Ebury Road Works. Two shops and bakehouse, Market Street, for E. Keen. Premises, Market Street, for the Co-operative Society, Ltd.

WEDNESBURY.—Probable re-erection (after fire) of the electrical department at the Old Parks Works of the Patent Shaft and Axletree Co.

WELLINGBOROUGH.—Shoe factory at Irthlingborough. A. Anderson, architect, 62, Abington Street, Northampton.

WHETSTONE (Leicester).—School for Leicester C.C. E. G. Fowler, 33, Bowling Green Street, Leicester.

WIGAN.—Four houses, Billinge Road and Calderbank Street; Calderbank and Sharrock, builders, Smethurst Street, Pemberton, Wigan. Nine houses, James Street; C. B. Holmes & Co., Ltd., builders, Cross Street, Wigan; thirteen houses in Caunce Road, Wm. Knowles; sixteen houses, Billinge Road, Pemberton, Messrs. Clough & Gaskell; two houses in Kenyon Road, J. Walkden; house and two shops, O. and G. Rushton, Ltd., grocers. New school, Beech Hill; Willink & Thicknesse, architects, Liverpool. Men's institute, Spring Gardens, All Saints Parish; Vicarage in Duke Street, Rev. H. F. Lloyd.

WINCHESTER.—Extension of St. Paul's Church. Admiral Rainier, Winton Croft, Winchester.

WORCESTER.—Secondary school for girls (£6,750), and extension of the grammar schools. City architect.

FORTHCOMING EVENTS.

Siemens' Stafford Engineering Society.—Friday, December 4th. At 8 p.m. At the Siemens Institute, Stafford. Paper on "Military Engineering," by Mr. H. G. Williams.

South-Western Polytechnic Institute Boys' Secondary School.—Saturday, December 5th. At Manresa Road, Chelsea. Entertainment at 7.30 p.m. Mrs. Hayes Fisher presents prizes and certificates to scholars, 8.30 p.m.

Electrical Football League.—Saturday, December 5th. Kick off 2.30 p.m. St James' Electric *v.* Ediswans, at Wormholt Farm. General Electric *v.* Robertson's Lamps, at Gunnersbury Avenue, Mill Hill Park.

P. & O. Batti-Wallahs' Society.—Monday, December 7th. At 7.45 p.m. At the Abercorn Rooms, Great Eastern Hotel, Liverpool Street, E.C. Smoking Concert.

Institution of Electrical Engineers (Glasgow Local Section).—Tuesday, December 8th. Meeting at 207, Bath Street, Glasgow.

Liverpool and District Electrical Association.—Tuesday, December 8th. At 8 p.m. At the Common Hall, Hackins Hey, Liverpool. Paper on "Electricity as Applied to Heating and Cooking," by Mr. S. R. Gibbon.

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, December 8th. At 7.30 p.m. At the Municipal School of Technology. Paper on "Single-Phase Railways," by Mr. P. C. Jones.
Saturday December 12th. Visit to the Morecambe and Heysham Electric Railway.

Institution of Civil Engineers (Students).—Wednesday, December 9th. Visit to the works of Messrs. Dewrance & Co.

Incorporated Institution of Automobile Engineers.—Wednesday, December 9th. At 8 p.m. Storey's Gate, St. James's Park, S.W. Mr. Mervyn O'Gorman on "How the Weight of a Motor-Car is Made Up."

Association of Engineers-in-Charge.—Wednesday, December 9th. At 7.30 p.m. At St. Bride's Institute, E.C. Paper on "Coal, its Composition and Combustion," by Mr. W. H. Booth.

Rugby Engineering Society.—The meeting set down for December 10th has been postponed to December 17th.

Institution of Electrical Engineers.—Thursday, December 10th. At 8 p.m. At the Institution of Civil Engineers. Papers on "Output and Economy Limits of Dynamo-Electric Machinery," by Mr. J. C. Maclarlane and Mr. H. Burge, and "Commercial Electric Heating," by Mr. John Roberts.

Institution of Electrical Engineers (Dublin Section).—Thursday, December 10th. Meeting at 8 p.m. At the Royal College of Science.

Physical Society.—Friday, December 11th. Meeting at 8 p.m. At the Royal College of Science, South Kensington. Fourth Annual Exhibition of Electrical, Optical and other Physical Apparatus, from 7 to 10 p.m. (see p. 990).

Junior Institution of Engineers.—Saturday, December 12th. At 3 p.m. Visit to garage and shops of London General Omnibus Co., at Black Horse Lane, Walthamstow. This visit is in connection with a paper that is to be read by Mr. Eric Boult on "Motor-Omnibuses," on December 16th.

North of England Institute of Mining and Mechanical Engineers.—Saturday, December 12th. Meeting at 2 p.m.

THE ELECTRICAL ENGINEERS

(LONDON DIVISION).

The following orders are issued:—

Monday, December 7th.—"A" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 8 p.m. Adjutant's lecture, 8 p.m.

Tuesday, December 8th.—"B" Company. Technical drill, 6 to 8.30 p.m. Infantry drill, 8.45 to 9.45 p.m. Medical inspection for recruits, 6.30 to 7.30 p.m.

Wednesday, December 9th.—Lecture by Capt. Phillips to corporals at 8 p.m. Any other N.C.O.'s can attend this lecture.

Thursday, December 10th.—"C" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 10 p.m.

Friday, December 11th.—"D" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 8 p.m. Adjutant's lecture, 8 p.m.

(Signed) J. H. S. Phillips,
Capt. and Acting Adjutant.

Football.—A match was played on Peckham Rye on the morning of Thursday, November 26th, between the L.C.C. Sub-stations' F.C., Southern Section, and Hammersmith and City Railway (B team). The result was:—Hammersmith, 4; L.C.C. Sub-stations, 2.

NOTES.

Electrical Engineers' Ball, 1909.—It has been decided to hold the 1909 ball on Friday, February 5th, at the Hotel Cecil. A large and influential Committee has been formed, with an Executive Committee consisting of the same gentlemen as on the last occasion. The honorary treasurer is Mr. Robert Hammond and the honorary secretaries are Mr. A. M. Sillar and Mr. H. Alabaster.

Electrical Banks in Germany.—A little time ago, when referring to the question of the proposed electrical bank in Germany, it was mentioned that on the announcement of the scheme the idea prevailed that the three large electrical groups would become associated with the comprehensive undertaking in contemplation, which is now stated to be on the point of realisation. Subsequent events, however, showed that only two groups—the Allgemeine Co. and the Siemens & Halske Co.—were acting in unison in the matter, and that they had succeeded in securing the support, which was withheld for some time, of some of the leading banking institutions in that country. It now turns out that the other group—the Felten & Guilleaume-Lahmeyer Works Co.—does not intend to be behindhand in enterprise of this kind, seeing that the company has resolved, very rapidly as it appears, to establish an electrical bank on its own account with a share capital of £1,250,000, and the intention to issue obligations of £3,750,000, thus making a total of £5,000,000. This is a considerable sum, although it is not quite so large as the combined share and bond capital attributed to the joint promotion of the other two groups. According to information apparently drawn from inspired sources, one fourth of the share capital in the F.G.-L. bank will be paid up as a beginning without the assistance of any banking institution, and in so far as the available funds of the Felten & Guilleaume-Lahmeyer Works Co. do not suffice for the purpose, the large shareholders, such as the Lahmeyer Co. and the Guilleaume family, will provide the money; whilst the co-operation of banks will be requisitioned for the ultimate issue of obligations. The money realised by the issue of obligations will be advanced to large or prospective consumers of electric light and power in order to enable them to carry out works or improvements, and they will effect repayments to the electrical bank in the form of annuities. In this way it will be possible for manufacturers and others to avoid the raising of loans on unfavourable terms or of seeking bank credit, and to defray the cost of the improvements gradually out of the increased working results arising from the transformation. Apart from the question of the conversion of railways to electric traction, the bank proposes to assist the smaller towns and districts in the establishment of electric tramways and to devote attention to the electrical needs of heavy industries, including coal mining. It will be understood that operations of these kinds will only be undertaken on the basis of unquestionable security, which, in the case of industrial undertakings, would take the form of mortgages, bank guarantees or guarantees of large shareholders. The impending formation of electrical banks recalls the experience gained with the financing institutions which were associated with various manufacturing firms several years ago, and which did not prove altogether satisfactory to the promoters. There is, of course, a material difference between those institutions and the new creations in the form of banks, but, at the same time, it will be essential for considerable caution to be exercised in the conclusion of transactions, if the banks are to become prosperous undertakings.

Concert.—On Tuesday, the 24th inst., a concert was given in the Recreation Hall at the Paisley District Tramway Co.'s depôt, Elderslie. An interesting and varied programme was given by Miss Jenny Sillars, of Glasgow, and party.

Electrical Football League.—Last Saturday, at Willesden, Metropolitan Electric easily defeated St. James' Electric by five goals to nil.

Appointment Vacant.—Junior meter assistant for the Birmingham electric supply department (£100).

Electrical Engineers, Dover.—At the invitation of the officers, N.C.O.'s and men of the Dover Company of the Electrical Engineers, a large number of the officers and members of the various branches of the Territorial and Regular Forces in Dover met at a smoking concert in the Drill Hall, Northampton Street, Dover, on Wednesday evening last week. This was the first social gathering since the formation of this company of the Electricals. Major Marx (commanding the Kent and Sussex Fortress Companies of the Royal Engineers) presided; the guests included the Rt. Hon. G. Wyndham (M.P. for Dover), and the Mayor and Deputy Mayor of Dover. The chairman, in proposing the toast of the visitors, stated that the company was started on August 1st, and was now 59 strong. An excellent musical programme was provided.

Electrical Gas Detector.—An electrical apparatus for the detection of combustible gases in the air in submarines or in confined spaces in large ships, has been approved by the Admiralty. It has been designed by Mr. Arnold Phillip, B.Sc., Admiralty chemist at Portsmouth Dockyard, and Mr. L. J. Steele, M.I.E.E., electrical engineer at Portsmouth Dockyard. The instrument will permit of a complete test of the conditions of air in any enclosure being made within five minutes, and will also indicate the presence of as little as one-third of the amount of gas or vapour necessary to render the air combustible or explosive.

Submarine Telephone Cable. — A remarkable order for cable has recently been executed by Messrs. W. T. Henley's Telegraph Works Co., Ltd. It consists of a 10-pair submarine telephone cable, each conductor being composed of 3/22 S.W.G. tinned-copper wires, insulated with pure and vulcanised india-rubber, taped with waterproof tape, twisted up in pairs, cabled together with tanned jute wormings, covered with tanned jute yarn, armoured with 27 galvanised iron wires each ·238 in. in diameter, served overall with two heavy coverings of prepared jute and impregnated with waterproof compound—overall diameter $2\frac{3}{4}$ in. This cable was manufactured for the Bell Telephone Co. of Canada, and was shipped from London to Quebec on drums; the longest length, 4,260 ft., was delivered on one enormous drum measuring some 11 ft. high × 7 ft. wide, and weighing 16 tons gross. The cable was laid under the Quebec River (*i.e.*, the St. Lawrence River) between Quebec and Levis.

The Turbinal Tubeless Boiler.—The latest thing in boilers to appeal to the public favour is the turbinal tubeless boiler, a small affair of concentric annular conical vessels with narrow water spaces and narrow flame spaces, heated by a liquid fuel burner from below. The steam produced in the boiler proper descends through a helically-coiled superheater tube placed in the middle space of the innermost cone. The issuing steam is dried and comes out at a high temperature, something that may be over 600° F. It might have been anticipated that with such narrow water spaces all the water would have passed off as foam or priming, but somehow the boiler, when at work, appears to resolve itself into one of the semi-flash variety, and works exceedingly well. So much is this the case that it appears to us that considerable use may be made of this boiler for fire engines, commercial motor vehicles, and small steam installations generally which demand high steam pressure and rapid steaming from liquid fuel. We should not recommend it for large boilers, because in large sizes its weight would soon become very great. But this objection does not hold for small boilers, and the Steward patent boiler is well worth examination. When at work it will contain very little water, and should be safe from severe explosive effects. We have no information as to the efficiency or capacity of the boiler. There are points, of course, which can only be properly elucidated by a thorough test by some reliable expert, for one can scarcely place much weight on a report without figures.

Legal.—D. N. and M. L. Macaulay *v.* Great Northern, Piccadilly and Brompton Railway Co.—Before Mr. Justice Lawrance and a special jury in the King's Bench Division this week, Mr. Daniel Neil Macaulay, a linen merchant, of Belfast, and his wife, sued the Great Northern, Piccadilly and Brompton Railway Co. to recover damages for personal injuries.

Sir Edward Clarke, K.C., and Mr. Merlin were for the plaintiffs, and Mr. Roskill, K.C., and Mr. Shakespere for the company.

It appeared that in April, 1907, Mr. and Mrs. Macaulay were on their honeymoon in London, and while they were in the lift at Holborn Station, about to ascend, the body of a man crashed through the roof and knocked them down. The man who had fallen was Mr. Tomlinson, who was said to be an employé of the company. He had opened the lift door at the top of the shaft and had fallen 90 ft. The company alleged that the man's act was one of suicide, and that they were not responsible, as the man was not on duty at the time of the occurrence.

Evidence was given on either side.

With regard to evidence about fastenings, Mr. A. Rorear, the defendants' engineer, said that in his opinion the defendant company had the best fastenings that could be adopted for lifts, having regard to the safety of the public and the requirements of the traffic service.

The jury, after an hour and a quarter's deliberation, returned a verdict for plaintiffs, and awarded Mr. Macaulay £750, and Mrs. Macaulay £200.

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Wednesday last week, a paper on "Natural and Induced Draught Systems," was read at Leeds by Mr. W. N. Y. King; and on Tuesday last, at Manchester, Messrs. A. P. M. Fleming and K. M. Faye-Hansen, read a paper on "Transformers." Abstracts of these papers will appear in later issues.

Royal Society.—The annual meeting was held on Monday last, Lord Rayleigh presiding. The new president is Sir Archibald Geikie, with Mr. A. B. Kempe as treasurer, Profs. J. Larmor and J. R. Bradford as secretaries, and Sir W. Crookes as foreign secretary. At the anniversary dinner on the same evening, Sir A. Geikie presided, and about 200 guests were present.

Liverpool and District Electrical Association. — On Saturday, November 28th, a party of members of this Association paid a visit to the Birkenhead Corporation Electricity Works (lighting and traction). The visitors were met on arrival by Mr. W. Wylde, the chief engineer, and Mr. G. P. Shallcross, the assistant engineer, when an inspection was made of the entire plant, boiler house, engines, generators, and much interest was manifested in the meter-testing department.

On Tuesday, November 24th, a paper was read by Mr. W. H. Hamilton on "Electricity Meters."

Siemens Stafford Engineering Society.—This Society held its first annual conversazione on Friday, November 20th, in the large hall of Siemens' Institute, which was suitably decorated. In addition to the major portion of the staff of Messrs. Siemens Bros. Dynamo Works, Ltd., a large number of local residents were present. The guests were received by the president, Mr. W. Schiller, and Mrs. Schiller. The exhibits were typical of recent advances in science and engineering, and were for the most part arranged by members of the Society, although there were a number of other notable exhibits, including:—Brennan mono-rail, by Mr. J. K. Catterson-Smith; Colour photography, by Mr. Herbert Hey; Carborundum, by the Vincit Co.; Welding, by the Thermit Co.; Domestic heating apparatus, by the B.T.-H. Co., Rugby; Tantalum and carbon lamps, by Siemens Bros. Dynamo Works, Ltd., London; Cable specimens, by Siemens Bros. & Co., Woolwich; and Engineering exhibits, by Siemens Bros. Dynamo Works, Ltd., Stafford. The following exhibits were arranged by the Exhibits Committee and members of the Society:—Vortex rings, Gyrostats, Geissler tubes, Harmonograph, The Egg and the Induction Motor, Soap bubbles, Microscopes, Antiquarian specimens, Local birds' eggs, Airship model. Mr. Catterson-Smith lectured on gyrostatics, Mr. Hey showed some beautiful colour lantern slides, and Mr. A. F. Campbell Pollard expounded smoke-rings in the light of mathematics and an arc lantern. The lighter side of the programme included a short concert, a sketch by the Siemens Amateur Dramatic Society, and selections by the Siemens Institute Orchestra.

Institution of Electrical Engineers (Newcastle-on-Tyne Local Section).—The annual dinner of the Newcastle-on-Tyne Local Section of the Institution of Electrical Engineers was held in Newcastle on November 25th. The chair was occupied by Mr. A. L. E. Drummond, chairman of the Local Centre. Mr. Summers Hunter gave the toast of "The Institution of Electrical Engineers." He said that that local section formed a very important part of the Institution, for he did not know any part of the country, or of Europe, where electrical development had been so great, and the possibilities had been so closely studied and practically demonstrated as on the North-East Coast. On Tyneside they had the largest power station in Europe, and that power station owed its commencement practically to local men. Manufacturers in that district realised very quickly the important part that electricity would play in the carrying-on of the workshops from an economic point of view, and they had not been misled. Mr. W. M. Mordey, the President, said it was a great honour to be President of their Institution, which now numbered over 6,000 engineers. He had been very much impressed with the vein of pessimism that ran through everything connected with English electrical engineering. He had been a very great deal abroad, and after a close study of this question, he had come to the deliberate conclusion that they were not behind other countries. The city of Newcastle-on-Tyne was leading the whole world in the amount and the low cost of its electrical energy, and Newcastle was not far ahead of other large towns in England. There were other towns, like Sunderland and Bolton, that were actually supplying their public with energy at a cheaper rate than towns like Geneva, Grenoble, Lyons, Zurich and other places that had great ranges of mountains near them, and were provided with ample water power all the year through. Mr. F. Tremain gave "The Armstrong College and the Learned Societies." Sir Isambard Owen, Mr. Summers Hunter and Mr. F. J. Edge responded.

King's College Engineering Society.—The fifteenth annual dinner of this Society was held on Saturday last at the Trocadero Restaurant, Sir William H. Preece presiding. "The College and Staff" were proposed by Mr. E. A. Greene. Prof. D. S. Capper, who responded, referred to the proposal to form an officers' training corps in connection with the college. Sir William Preece proposed "The Engineering Society," and Mr. T. H. M. Barnett, president of the Society, replied.

Institution of Electrical Engineers (Birmingham Local Section).—At the first meeting of the session, on November 11th, Prof. Kapp, the chairman, referred to the success that had attended the formation of the three local companies of the electrical engineers under the Territorial Army scheme, the corps being now up to full strength. The proposal to extend the district covered by the Local Section had been referred to the other local sections, and was still under consideration.

Institution of Municipal Engineers.—On Wednesday last week, 30 out of 50 applications for membership and 4 for studentship were accepted. The roll of the Institution now is: Members, 386; Students, 9. A general meeting is to be held on January 16th, 1909.

Fatality.—It is reported that an electrical engineer named Nicholls, who had been in the employ of Messrs. Elliott Bros. for the past 30 years, was found unconscious on the railway line on November 30th, near Ladywell Station. It is assumed that he missed his footing on the platform in the fog. He died on the way to the hospital.

NEW COMPANIES REGISTERED.

Thomas Kesnor & Co., Ltd. (100,419).—This company was registered on November 26th, with a capital of £8,000 in £1 shares, to adopt an agreement with H. J. Norbalie, J. L. Lawson and G. Lawson, trading as "Thos. Kesnor & Co.," and to carry on the business of electricians, engineers, manufacturers of and dealers in electrical and other machinery and apparatus, &c. The subscribers (with one share each) are:—J. L. Lawson, care of Thos. Kesnor and Co., Armadale Road, Fulham, S.W., engineer; W. G. Dunstall, 2, Norfolk Street, W.C., secretary. Private company: The number of directors is not to be less than two or more than five; the first are H. J. Norbalie, J. L. Lawson, G. Lawson and W. G. Dunstall; qualification, £50 shares or stock; remuneration, 10s. 6d. each per board meeting attended. Registered office, Armadale Road, Fulham, S.W.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Willesden U.D.C. has appointed MESSRS. J. C. JOHNSON and J. D. RAVENSCROFT charge engineers to fill two vacancies.

MR. FRANK H. MINCHIN has been appointed junior assistant engineer at the Leek U.D.C.'s electricity works.

MR. J. SARGINSON, at present employed as station foreman at the Liverpool tramways electric power and lighting department at £220 per annum, is to be appointed assistant superintending engineer of stations at a salary of £250 per annum.

On Friday, 27th ult., the staff of the Hertford electricity works presented MR. H. J. FISHER, who left that day to take up an appointment as junior assistant at Grays, with a calculating slide rule. The presentation was made by Mr. J. M. Bowman, resident engineer.

The Central London Railway, Power House, Tug-of-War Team and friends, to the number of about 50, held their annual dinner at the White Hart Hotel, Acton, on Friday evening last. The occasion was utilised to present the Captain of the Team, MR. CHARLES FORGAN, power house superintendent, with the Acton Challenge Cup, which had this year been won outright, and in making the presentation, Mr. E. P. Grove, chief engineer, took the opportunity to remark upon the unique record of the team in not only winning this cup three years in succession without once being pulled over the line, but also in competing against, and beating, some 90 teams, at the *Evening News* Stadium Sports, when they won the Championship of London.

The salary of MR. R. JONES, chief assistant at the Dartford electricity works, has been increased from £130 to £140 per annum as from January 1st next, with a further increase of £10 on January 1st, 1910.

General.—In making their appointments last week, the Accrington Town Council chose the following as chairman and vice-chairman of the Electricity Committee:—ALDERMAN HIGHAM and COUNCILLOR C. F. BURY.

MR. G. C. LLOYD, who has so capably served the Institution of Electrical Engineers as secretary for the last 4½ years, has been appointed to the secretaryship of the Iron and Steel Institute, recently rendered vacant by the death of Mr. B. H. Brough. Mr. Lloyd, prior to his appointment with our own Institution, was assistant secretary of the Institute which he is now to rejoin as secretary. It will be remembered that he succeeded the late Mr. W. G. McMillan as I.E.E. secretary in 1904, and during his term of office he has proved himself to be a man of very lofty ideals, high integrity and tenacity of purpose, as well as being a hard worker in a quiet way.

Many of our readers may be interested to know that MR. ELVY ROBB, of Tunbridge Wells, has been selected as Unionist candidate for East Manchester. For 7½ years Mr. Robb was chairman of the Electricity Committee of Tunbridge Wells, and he was once mayor of the borough. That Mr. Robb is a hard fighter against unfair practices or unsound finance and methods in municipal trading is well known to our readers. If he succeeds in winning East Manchester, he should be the means of carrying to St. Stephens a fairly close knowledge of electrical affairs.

The Council of the Royal Society of Arts has elected SIR WM. H. PREECE to fill the vacancy caused by the death of Sir Charles Malcolm Kennedy.

MR. HORACE L. P. BOOT, consulting engineer and general manager, Tunbridge Wells Corporation Electricity Works, has been elected a member of the Council of the Institution of Municipal Engineers.

The vacancy as telegraph superintendent of the Blackburn General Post Office, caused by the retirement of Mr. C. Newby, after 38 years' service, has been filled by the appointment of MR. JOHN KENYON, assistant superintendent of postal telegraphs.

ALDERMAN W. THOMPSON and COUNCILLOR C. HIGHAM have been appointed chairman and vice-chairman respectively of the Blackburn Electricity and Tramways Committee.

COUNCILLOR D. HARTLEY has been elected chairman of the Nelson Electricity and Tramways Committee, vice Alderman A. Nelson, who resigned as a protest against a Finance Committee appointment.

MR. S. ALEXANDER FOX has joined the board of directors of W. Sisson & Co., Ltd., high-speed engine and marine machinery makers, and will continue to be responsible for the technical work of the company.

Obituary.—DOUGLAS WELLS.—We regret to record the death, which occurred at Brussels, from apoplexy, on November 20th, of Mr. Douglas Lewis de Knevett Wells, M.I.E.E. Mr. Wells was only 40 years of age. He will be remembered in this country as having been for many years an agent on the Continent for various British electrical manufacturing firms.

ROBERT FARR.—The death has occurred at the age of 86 years of Mr. Robert Farr, for 50 years a member of the firm of Messrs. R. Farr & Son, electrical engineers, Baxter Gate, Doncaster.

By the death of MR. ALEXANDER ADAMS the Glasgow Corporation electricity department has lost one of its oldest officials. Mr. Adams had been in the service of the department since its start in 1892, and latterly was mains superintendent for the central district of the city. He was esteemed both by his colleagues and by the electrical profession throughout the city as an energetic and capable engineer. His funeral took place at Riddrie Cemetery, and was attended by the chief engineer, the principal officials and a number of workmen from the electricity department, as well as by representatives from Masonic Lodge "Progress," of which Mr. Adams was a prominent member.

CITY NOTES.

Amazon Telegraph Co., Ltd.

THE meeting of this company was held on Tuesday at the offices, 42, Old Broad Street, Mr. George Keith presiding.

The CHAIRMAN, in moving the adoption of the report, said he was pleased to say that the accounts showed an increase in revenue and a decrease in expenditure, somewhat similar to what was the case in the previous year. The traffic over the cables in the first half of the year showed a large increase, but it fell off in the second half owing to the great fall in the price of rubber and the consequent general depression of trade in the Amazon. On the other hand, the value of the Brazilian currency had been very steady on the basis of 15d. to the milreis, and there had not been any loss due to fluctuations of exchange such as had occurred in previous years. The traffic receipts came out at £67,022, showing an increase for the year of £818. The subsidies, amounting to £17,125, had been fully earned, and those amounts, together with £831 interest on cash balances, gave a total revenue of £84,978, which was higher than it had ever been before. Last year the amount was £83,815 and the year before that £81,183, from which they would see that there had been a favourable advance year by year. The cables had worked remarkably well during the year; the condition of the river had been more than usually favourable to their maintenance, and there had been fewer repairs needed. As a consequence, the expenses attending the maintenance of cables showed a decrease of £5,188. It was necessary to bear in mind that the cables were becoming older every year, and the amount of cable used for repairs might increase rather than diminish as time went on. The total working expenses had amounted to £43,174, showing a decrease of £4,898. After providing for interest and redemption charges on the 6 and 5 per cent. debentures, and meeting the working expenses, there remained a surplus for the year of £14,808, which reduced the debit balance standing against the revenue account to £51,070. The improved results of the year's business were practically due to the better working of the cables and to the diminished cost of their maintenance. At the same time the loss of traffic receipts was very considerable, while the interruptions which took place were being repaired. Those losses occurred more or less every year, and could not be obviated with a single line of cable. The duplication of the main cable was, consequently, becoming more and more necessary in order to obviate such losses and to provide a continuous and permanent communication, and for that purpose a suitable route had already been surveyed and selected. They had also been in communication with the Brazilian Government on the subject, and had every hope that their petition for the assistance necessary to enable the work to be carried out, would be granted on the basis of an extension of the period of the concession and the payment of the present subsidy for a further term of years.

MR. E. B. ELLICE-CLARK seconded the motion, and the report was adopted.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.

THE annual meeting of the shareholders of this company was held on Thursday of last week at Winchester House, Old Broad Street. Lord Arthur Butler presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, November 27th, page 941), said that during the year a new sub-station had been erected at Cliftonville which had enabled the company to cope with the increased lighting demand on the Margate portion of the system. Loans upon deposit of debenture stock had been decreased in the year from £48,000 to £46,000. Sundry creditors were £1,204 against £2,521 in the previous year. The balance of revenue brought forward was £863, which with £4,652 brought in to the account this year made a total of £5,516. The directors recommended that £2,500 should be added to the reserve fund bringing it up to £5,500; that a dividend of 1¼ per cent. should be paid on the preference shares, amounting to £1,875, leaving £1,141 to be carried forward. The general expenses for the year had amounted to £10,688 against £11,956, a decrease of £1,267. Accident insurance showed a decrease of £539, and he was glad to say that the company had been free from liability for any accidents of a serious nature during the year. The amount paid for third-party insurance was £950 from June 16th, 1908, to June 15th, 1909, as against £1,400 for the previous 12 months. The directors

would use their best endeavours to get this amount further reduced when the time came, as they hoped that should the company escape any serious accident they would be able to effect a still further reduction. There had been an increase of £628 in the expenses of the power station. Nearly the whole of this was due to the high price of coal and coke during the year. The directors had, however, succeeded in obtaining a considerably reduced tender for the current year, and it was hoped that in the next account the charges for fuel would be decreased by the amount now shown as an increase. Maintenance of rolling stock showed an increase of £275 18s. 9d. Permanent way showed an increase of £381 18s. 7d. during the year, some 2½ miles of track having been lifted and re-ballasted and many points and crossings renewed. Machinery repairs showed a decrease of £273 16s. 1d., notwithstanding that considerable repairs and renewals of boiler tubes had been effected to meet insurance company's requirements. The directors had again waived one-half of their fees for the year. As regarded the receipts, traffic during the year decreased by £580, which decrease was, however, practically met by careful management by the reduction of £526 in traffic and general wages. Lighting showed an increase in revenue of £237. Thirty-four new consumers using 3,004 8-C.P. lamps had been connected, making the total 8 C.P. lamp connections equivalent to 24,053. The introduction of metallic-filament lamps had been the means of making their increase in revenue smaller in comparison with last year, but this he felt sure was only a temporary set-back, as many new applications were now being made for connection to the lighting mains, and as the effect of the use of metallic filament lamps was to reduce consumption of electric current, the cheapening of the light would, no doubt, be an inducement to new consumers to come in. The car-miles run had decreased from 756,201 in 1907 to 721,854 last year, and the passengers carried had decreased by 160,452, the number being 4,195,014 last year, as compared with 4,355,466 in 1907. The weather had greatly affected their traffic, having been very wet and showery during the summer. At the beginning of June a re-arrangement of certain fares was made, which had been a source of profit. In the report the directors had referred to the necessity of increasing their plant at the power station. The present plant was being used to the utmost limit of its capacity, and in order to enable the company to extend its lighting business it was most desirable that the installation should be increased. They had received various applications for the supply of electric current, notably from Lloyd's telegraph station and from the Margate Seabathing establishment, and it would be impossible to meet these applications without further expenditure on machinery. If the sum of £7,500 mentioned in the report was expended in the way suggested, it would put them in a position to meet these and other similar applications for some time to come, and thus, he hoped, secure a substantial additional revenue. With a view to considering the best means of raising additional money for this purpose, the directors had invited some of the principal shareholders who were concerned with financial affairs in the city, to consult with them on the subject.

A long discussion ensued, in which several shareholders strongly criticised the management of the company.

The report was adopted, and a committee of four shareholders was elected to confer with the directors on the position of the company generally.

Bruce Peebles & Co., Ltd. (In liquidation).

Messrs. A. W. Tait and J. A. Robertson Durham, the joint liquidators, have issued the following circular from East Pilton, Edinburgh, under date November 27th:—"We beg to inform you that on the 10th inst. the Lord Ordinary sanctioned the scheme of arrangement, a print of which has already been sent to you. The objectors had 14 days thereafter to appeal against the interlocutor sanctioning the scheme. No appeal has been intimated, and, therefore, the scheme is now approved of, and we are in a position to proceed with the necessary arrangements. The first directors of the new company are:—

Mr. Charles H. M'Euen, of Callenders' Cable Co., Ltd.
Mr. M. B. Mountain, of Mountain & Gibson, Ltd.
Mr. Alexander Mackenzie, of Mackenzie & Moncur, Ltd.
Mr. F. E. Andrews, of Brush Electrical Engineering Co., Ltd.
Mr. C. J. Shields, chartered accountant, Edinburgh; and
Mr. A. W. Tait, chartered accountant, London.

"The scheme stipulates for its adoption by the new company within six weeks after it is sanctioned by the Court. The gentlemen nominated as directors of the new company have had a meeting to-day, and have instructed the solicitors to proceed with the registration of the new company. They have arranged to meet again as directors on Tuesday, December 8th, and as soon as possible thereafter the shareholders will be communicated with and will be offered the shares to which they are entitled. Thereafter the liquidators' adjudications upon the claims which have been lodged in the liquidation will be submitted to the Court, and the Court will be asked to allow the deliverances to be intimated to the different creditors. Those creditors whose claims have not been admitted in whole or in part will then have an opportunity of stating their objections to the liquidators' deliverances. After the deliverances are all approved of or adjusted, the debenture-holders and creditors will receive what they are entitled to under the scheme of re-arrangement. The debenture-holders, creditors and shareholders may rest assured that the liquidators will do everything in their power to have the arrangements connected with the transference of the business to the new company and with the settlement to the shareholders and creditors completed as soon as they possibly can"

Stock Exchange Notices.—The Committee has appointed special settling days as under:—

Thursday, December 10th.—Metropolitan District Railway Co.—£550,000 4 per cent. prior lien debenture stock.

The stock is also to be officially quoted.

Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

North Metropolitan Electric Power Supply Co.—£126,500 5 per cent. mortgages of £100 each, Nos. 1 to 1,265.

R. Waygood & Co., Ltd.—An interim dividend of 5 per cent. on the ordinary shares for the six months to September 30th has been declared.

Reduction of Capital.—*British Electromobile Co., Ltd.*—In the Chancery Division on Saturday, November 28th, Mr. Justice Neville had before him the petition of this company, for the sanction of the Court to a reduction of capital. Counsel for the petitioners explained that it was proposed to cancel certain shares which had been surrendered under an agreement by some of the shareholders, and the company asked to be allowed to reduce its capital by £3,928, the face value of those shares. The company was incorporated in 1907 for the manufacture of electric broughams and motor carriages, and also for the letting of them out on hire. His Lordship sanctioned the reduction, and the omission after one month of the words "and reduced" from the title of the company.

Rhodes Motors, Ltd.—A petition for confirming the reduction of the capital from £60,000 to £31,000 is to be heard on December 8th, before Mr. Justice Neville.

County of Durham Electric Power Supply Co.—The accounts of this company for the year ending December, 1907, were published in full in the *London Gazette* for November 27th. The revenue account is as follows:—

Dr.		
Current purchased from Newcastle E.S. Co.	...	£41,939
Rents payable...		734
Insurances, superannuation, &c.		104
Total expenditure		£42,777
Cr.		
Sale of current per meter		£7,369
Ditto, under contracts		38,449
Rents receivable		2,149
		£47,967

This leaves a balance of £5,190, plus £47 brought forward, carried to net revenue account, and standing at credit thereof.

Prospectus.—*Monterey Railway, Light and Power Co.*—Until Monday next the list is open of subscriptions to an issue of £1,000,000 5 per cent. first mortgage debenture stock in this Mexican company. The directors include Mr. W. Mackenzie, who is connected with various Canadian and Sao Paulo electrical companies, Mr. R. M. Horne-Payne, and Mr. George Flett (of Dick, Kerr & Co., Ltd.).

John Brown & Co., Ltd.—An interim dividend at the rate of 5 per cent. per annum is recommended.

Richard Hornsby & Sons, Ltd.—The report for the year ended September 30th shows that there was a profit on working of £55,461 after writing off depreciation and paying directors' fees. After meeting debenture interest and preference interim dividend, £43,209 remains as a disposable balance, out of which a further dividend on the preference shares, making 6 per cent. for the year, is being paid, also 6½ per cent. on 5,545 new shares, and 6½ per cent. on the ordinary shares. £15,000 is placed to reserve, £2,500 is written off patents, and £4,243 is carried forward.

Geneva Tramways Co. (1906), Ltd.—The Hon. A. G. Brand presided at the annual meeting, held at Salisbury House on November 25th. He said that the increased wages demanded almost entirely counterbalanced the increased receipts. It is anticipated that a power contract will shortly be concluded with the town of Geneva. The report was adopted.

Société des Tramways de Constantinople.—This company has convened a general meeting for the end of December to consider a proposal to increase the capital by the issue of 17,617 new shares, thus bringing the total to 50,000, of which 14,429 are preference shares; and to create £320,000 in the form of 4½ per cent. bonds. The proceeds of the emissions are to be devoted to the construction of four new lines, although an understanding has not yet been arrived at with the municipal authorities in regard to the introduction of electric traction. As far as concerns the new issues of capital, it was recently reported that French interests had obtained a majority control, and that the orders for the electrical equipment would be mainly placed with French firms. The Continental Company for Electrical Enterprises, however, contradicts the report, and states that the group associated with it retains the majority of the capital, and that only a portion of the contracts will be entrusted to French firms in connection with French acquisition of a block of the new shares.

Belgium.—La Compagnie Belge d'Electricité Siemens-Schuckert, of Brussels, has declared a dividend of 6 per cent. for the last financial year.

France.—The report of the Compagnie d'Electricité de l'est Parisien (Est-Lumière), of Paris, for the last financial year shows a profit of £29,342. A dividend of 5 fr. per share has been declared.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc.
Aberdeen	Nov. 25	2,366	— 3	26	36,880	— 174	14·4	..
Ayr	,, 28	360	— 1	28	9,788	— 252	8	..
Bath	,, 25	1,282	— 13	47	35,506	— 2,305	18	..
Belfast	,, 27	7,089	— 239	25	127,142	— 1,156	37	..
Birkenhead	,, 29	2,014	+ 20	35	37,608	+ 400	13·52	..
Birmingham Corp.	,, 21	12,778	— 279	34	215,413	— 6,703	56·46	..
Blackpool Corp. ..	,, 17	3,906	— 889	..	37,578	— 983	11·67	..
,, —Fleetw'd.	,, 28	460	+ 39	21	20,494	— 1,776	8·25	..
Bolton	,, 29	4,268	+ 145	35	81,737	+ 1,254	26	..
Bournemouth ..	,, 25	2,436	+ 3	34½	69,078	— 2,929	21·72	..
Bradford	,, 21	8,684	+ 29	33	160,468	+ 487	54·9	..
Brighton	,, 29	1,480	+ 115	24	33,822	+ 780	9·5	..
Bristol	,, 27	9,494	+ 367	..	..	..	31	..
Brit. Elec. Trac. Co.								
Airdrie	,, 20	443	— 21	46	10,227	— 61	3·65	..
Barnsley	,, 20	341	..	,,	8,215	+ 431	..	..
Barrow	,, 20	415	— 53	,,	11,597	— 594	5·37	..
Cavehill	,, 20	126	+ 3	,,	4,120	+ 160	..	..
Devonport	,, 20	913	+ 87	,,	21,613	+ 326	8·85	..
Gateshead	,, 20	1,960	— 29	,,	46,779	+ 77	11·25	..
Gravesend	,, 20	346	— 84	,,	9,813	— 1,614	6·5	..
Greenock	,, 20	989	— 160	,,	24,437	— 6,069	7·25	..
Hartlepool	,, 20	390	— 105	,,	11,109	— 2,376	6·72	..
Kidderminster ..	,, 20	159	— 29	,,	5,186	— 401	..	..
Leamington	,, 20	252	+ 41	,,	8,083	+ 512	3	..
Merthyr	,, 20	437	+ 17	,,	9,837	+ 57	2·9	..
Metropolitan	,, 20	10,740	+1,858	,,	267,598	+50,357	22	..
Middleton	,, 20	578	— 46	,,	16,532	+ 65	8·5	..
Mid. Joint Com'tee	,, 20	11,003	— 603	,,	266,250	— 6,021	..	..
Oldham—Ashton	,, 20	1,025	— 100	,,	27,299	— 807	9·13	..
Peterborough ..	,, 20	199	— 12	,,	5,978	— 11	5·31	..
Potteries	,, 20	3,609	— 336	,,	83,689	— 2,509	29	..
Rothesay	,, 20	84	+ 1	,,	9,681	— 502	2·75	..
Southport	,, 20	435	— 8	,,	13,194	— 776	8·17	..
S. Metropolitan ..	,, 20	1,389	— 21	,,	37,789	+ 432	..	..
Swansea	,, 20	1,850	— 41	,,	43,892	+ 1,067	12·5	..
Tynemouth	,, 20	218	— 22	,,	10,611	— 771	3·75	..
Weston-s-Mare ..	,, 18	53	+ 1	,,	6,668	— 505	3	..
‡Worcester	,, 20	467	— 9	,,	13,147	— 92	5·75	..
Wrexham	,, 20	184	— 2	,,	4,768	— 11	..	..
Yorks. Wool. Dist.	,, 20	1,694	— 26	,,	42,511	— 822	17	..
Miscellaneous ..	,, 20	350	— 38	,,	9,646	— 760	..	..
Burnley	,, 28	2,078	— 219	..	..	..	7·5	..
Burton-on-Trent ..	,, 29	473	— 4	35	9,578	— 603	10	..
†Bury	,, 29	1,074	+ 89	34½	41,346	+ 1,772	22·5	..
Cardiff	,, 21	3,982	+ 89	34	74,342	— 69	..	..
Carlisle	,, 28	317	+ 11	47	8,404	+ 7	..	..
Chatham and Dist.	,, 26	1,444	+ 241	47	37,200	+ 2,694	14·98	2·82
Cork	,, 26	892	+ 97	47	21,834	— 425	9·89	..
Croydon	,, 27	2,503	+ 80	35	49,969	— 471	11·25	·75
†Darlington	,, 28	189	— 21	35	6,969	— 553	..	..
†Darwen	,, 20	224	— 14	38	8,541	— 249	4·36	..
Dover	,, 21	312	— 8	34	7,873	— 318	4·75	..
Dublin	,, 27	9,453	+ 78	..	117,967	—28,602	54·25	5·5
Dundee	,, 25	2,221	+ 95	27⅞	33,7·0	+ 1,689	14·5	..
East Ham	,, 28	1,700	+ 72	35	30,868	— 1,072	8·48	·68
Exeter	,, 27	517	+ 50	35	11,382	+ 64	5·5	..
Glasgow	,, 28	33,190	— 111	..	447,681	— 8,511	90·5	1·5
Hastings	,, 26	1,523	+ 34	..	..	..	..	..
Huddersfield ..	,, 28	2,940	— 21	35	56,823	— 391	28·5	·5
Hull	,, 28	4,782	— 279	35	86,081	— 272	13	..
Ilkeston	,, 25	242	— 18	34	4,920	— 50	3·5	..
Ipswich	,, 28	599	— 20	35	14,261	— 290	10·5	..
Kilmarnock	,, 21	277	— 13	27	4,170	— 255	4·25	..
Lan'kshire Trm. Co.	,, 26	2,318	— 99	47	60,854	+ 3,073	17	1·18
Lancashire United	,, 25	2,377	+ 107	47	62,914	+ 2,496	89	1
Leeds	,, 21	12,358	+ 17	31	256,229	+ 3,641	96·75	·25
Leicester	,, 28	4,080	— 95	..	..	— 57	..	..
Leith	,, 21	963	+ 22	27⅞	14,801	— 35	6	..
Liverpool	,, 21	20,683	— 298	47	502,044	—10,449	104	..
‡L.C.C.	,, 14	69,542	+7,006	..	1,158,873	+129,655	121½	..
London United ..	,, 28	10,352	— 169	..	316,168	+ 4,027	..	..
Lowestoft	,, 28	312	— 15	9	1,488	— 85	3·5	..
Manchester	,, 28	28,456	+1,497	35	592,028	+13,580	89·5	11
Newcastle	,, 28	7,632	— 159	35	136,209	— 7,805	..	..
Newport	,, 28	1,225	+ 46	35	23,343	— 1,109	14·5	..
†Northampton ..	,, 10	482	+ 752	27½	13,377	..	5·5	..
Oldham	,, 29	3,718	+ 73	35	69,934	— 500	23·75	..
Pontypridd	,, 21	780	+ 208	34	13,035	+ 3,873	5·5	1·75
Portsmouth	,, 28	3,165	+ 203	35	72,755	+ 618	14·5	..
Preston	,, 25	1,356	— 11	..	..	..	..	..
Reading	,, 26	1,093	— 20	34⅜	21,766	+ 65	13·25	..
Rotherham	,, 26	1,174	+ 32	35⅞	21,802	+ 87	10	·66
Salford	,, 28	8,479	— 457	24	160,065	— 808	38·9	..
Sheffield	,, 29	10,587	— 270	35½	198,542	— 2,525	57	1·25
Southampton ..	,, 25	1,857	— 6	34	37,716	+ 1,566	..	..
Southend-on-Sea ..	,, 25	659	+ 183	35	16,767	+ 1,559	..	..
South Shields ..	,, 28	991	+ 1	35	19,870	— 348	..	..
Swindon	,, 25	244	— 47	..	..	..	4·4	..
Tyneside	,, 25	714	— 33	21	8,925	— 912	3·87	..
Wallasey	,, 28	1,580	+ 175	34½	31,787	+ 1,696	8·72	·22
Walthamstow ..	,, 28	1,080	+ 74	35	22,968	+ 1,182	9	..
West Ham	,, 19	4,111	— 58	34	75,673	— 3,810	15	·3
Wolverhampton ..	,, 25	1,518	— 81	34	29,047	— 684	12·5	..
Baker St.-Waterloo	,, 28	6,185	+ 300	22	66,655	+12,590	4·25	1
Cen. London Rly.	,, 28	11,588	— 294	22	160,276	+45,978	6·32	·45
Char. +, Eus. Hamp.	,, 28	6,925	+1,145	22	73,770	+15,995	7·75	..
City & S. Lon. Rly.	,, 29	6,289	— 655	22	66,569	— 2,001	7·3	1·05
Dublin-Lucan Rly.	,, 27	214	+ 37	21	5,074	+ 51	7	..
G.N. and City Rly.	,, 28	2,806	+ 933	22	29,496	— 7,388	3·5	..
G.N., P'dy. & Brmtn.	,, 28	11,020	+1,205	22	112,575	+19,780	9·25	·25
L'pool Overh'd Rly.	,, 29	2,681	— 90	22	30,830	— 5,629	6·8	4·8
Mersey Railway ..	,, 28	3,697	+ 59	22	41,228	+ 865	4·5	..
Metropolitan Rly.	Oct. 18	94 428	+2,781	16	259,904	+18,756	16	..
Met. District Rly.	Nov. 28	19,845	+2,554	22	204,663	+32,547	24	..
Anglo-Argentine ..	,, 25	58,456	+16,683	..	1,003,955	+215,229	43	..
‡Auckland	,, 6	12,295	+1,621	44½	135,708	+21,145	22·3	3·1
Bombay (B.E.T.) ..	,, 5	6,722	+1,051	46	105,969	+15,759	..	..
‡Brisbane	Oct. 8	14,910	+1,378	..	..	..	..	..
Calcutta	Nov. 28	6,565	— 68	..	..	..	..	..
‡Kalgoorlie, W.A.	Oct.	3,909	..	44	89,186	..	20·5	..
Madras	Nov. 15	1.149	— 18	46	25 927	+ 1,800	12·75	..
Perth (W.A.) ..	,, 27	2,763	— 56	48	65,448	— 1,422	26·6	..

* Compared with the corresponding period of 1907. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

Again, it is the electricity supply shares of the Metropolitan companies which stand out prominently as the best market of the week in the Stock Exchange. Electricity and beer divide the honours between them as being the strongest amongst stocks and shares. A considerable amount of attention in the newspapers is being devoted to the attractions of the electrical supply section, and this no doubt has assisted to force the market into the attention of the public. The rise, of course, is being reared upon the assumption that no new scheme will be likely to come forward now that the London and District Electricity Bill has failed, and the opinion grows which was mentioned here last week, viz., that promoters will be contented to give the proposition a prolonged rest.

The rises which have taken place during the past week are still more substantial than those which followed immediately upon rejection of the Bill. Chelseas have come up in fashion truly remarkable, scoring a gain of £1, and St. James' and Pall Mall improved to the extent of 22s. 6d., Bromptons being equally good. Following these are advances of 7s. 6d. in County of London Ordinary, 12s. 6d. in Westminster Ordinary, and 15s. in Brompton Preference, while other improvements ranging from 2s. 6d. to 10s. are scattered impartially down the catalogue. Debenture stocks move more slowly, but show gains in several instances.

Amongst the very few shares which have not greatly altered in price since we last wrote are Charing Cross, City Undertaking Preference, which are only ⅛ up at 4⅛. City of London Preference are at 12⅝, Kensington Ordinary at 7¼ and Notting Hill at 12¼ have not moved. Kensington Ordinary and Notting Hill shares can be mixed to produce rather more than 6 per cent. on the money, and the market appears somewhat to have overlooked these two.

Other supply shares beyond those of the London companies are very quiet. Victoria Falls Power Preference were marked up to 1⅛, a nominal rise of $\frac{3}{32}$, but it may be doubted whether the quotation has much solidity. The Mexican issues have grown less active; the Light and Power Common shares are ½ better, although the 7 per cent. Preferred stock lost a point.

Central London Railway stocks have been flat, but the Ordinary rallied well above the worst. All three classes quoted overleaf are 2 per cent. lower, and this in spite of the definite announcement that there will be another big Exhibition at Shepherd's Bush next year. Metropolitan Consolidated is a little easier, but Districts recovered, after dipping to 12. City and South London Ordinary lost 1½, the market having been a weak one for some time past, and the price, therefore, all the more susceptible to slight selling pressure. The 5 per cent. prior lien bonds of the Underground Electric Railways are up a point, but the other securities of the concern crumbled, and the 6 per cent. income bonds fell no less than 3½ points, to the round 20.

The little flutter of excitement caused by the announcement of capital reorganisation by the Anglo-Argentine Tramways is still an influence in the market, and the price of the Second Preference displays a slight improvement at 9$\frac{5}{16}$. British Electric Traction Preference are 5s. better, and British Columbia Electric Preferred has recovered the point shed recently. Rio Trams dropped to 77, but rallied to 78½, and Mexico Tramways Common stock has been pretty largely dealt in at prices round about 140. Rio bonds are 92½ and Mexico Tramway bonds 93¼.

Although the drop in Eastern Extension shares has received a check, the price of Eastern Telegraph Ordinary continues to droop, and at 132½ it is a point down, the 3½ per cent. Preference also being depressed. Indo-Europeans lost £1, and Globe Telegraphs, both Ordinary and Preference, are 5s. down. Nor is the Anglo-American group at all strong, and Direct United States shares are 5s. lower. Marconi's were jerked up $\frac{1}{16}$ again, and now stand restored to 11s. 3d.

American Telephone and Telegraph capital stock is down 1 to 134½, but travellers recently home from the States tell that it is considerably "tipped" out there, and for much higher values. Nevertheless, in any Yankee slump, such as is by no means unlikely to take place, the shares would, of course, be affected. National Telephones are quiescent. Monte Video Telephones declined a trifle. Western Union 4 per cent. Convertible and Redeemable "A" bonds are quoted at 87.

Further shrinkage in British Aluminium issues is noticeable in the manufacturing list: there seems to be no new reason for the fall in the shares.

Babcock & Wilcox are good, and Henley's Ordinary gained 10s. On the other hand, the depression in the cable market has spread to Telegraph Construction shares, which have given way to the extent of a sovereign. Rubber shares are less elastic, a punning dealer remarked, adding that the market has fallen into a condition of quietude from which the dividend declarations now being made are unable to dislodge it.

Tramway Club.—A recreation club, with rifle range and many other attractions, has just been opened by the South Shields Corporation tramways employés, under the organising supervision of Mr. L. E. Harvey, the general manager.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Nov. 24th.	Closing Quotations Dec. 1st.	Business done week ended Dec. 1st, 1908. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2½ — 3½	2½ — 2¾	..	..	— ½	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,950 Red.	100	Nil	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7¾%	7½%	8 %	8 %	134 —137	133 —136	135½	134½	—1	5 17 8
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 — 96	94 — 96	..	..	..	4 3 4
598,180	Anglo-American Telegraph	Stock	2¾%	3½%	3¾%	3½%	58 — 61	58 — 61	58½	..	..	5 14 9
3,200,910	Do. do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	102½—103½	102 —103	103⅜	102	..	5 15 11
3,200,910	Do. do. do. Deferred ..	Stock	Nil	1½%	1¾%	1 %	17⅛ — 17⅜	17 — 17½	17 7/16	17	— ⅛	5 15 11
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	8 — 8½	8 — 8½	..	..	..	4 14 1
2,883,376	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	88½— 90½	87 — 89	89	87	—1½	4 9 11
16,000	Cuba Telegraph	10	5 %	5 %	5 %	6 %	7½— 8½	7½— 8½	7⅝	..	..	7 1 2
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½— 17½	16½— 17½	16½	..	..	5 15 11
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8 — 8¼	8 — 8¼	..	..	..	5 14 3
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	8 14 10
60,710	Direct United States Cable	20	3¾%	4½%	4½%	4½%	13½— 13¾	13 —13½	13½	..	— ½	6 5 11
50,900	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,900, R.	100	4½%	4½%	4½%	4½%	100 —102	101 —103	..	..	..	4 7 5
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	132 —135	130 —135	131½	130	—1	5 8 8
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	84 — 86	83½— 85½	85½	84	— ½	4 1 10
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103½—105½	104½—105½	104½	103½	..	3 17 8
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	11⅝— 11¾	11⅝— 11¾	11⅝	11½	..	5 17 11
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	102	..	..	3 17 8
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½—101½	99½—101½	..	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5⅝%	5⅝%	5⅝%	5⅝%	10⅜— 10⅝	10⅜— 10⅝	10⅝	10⅜	— ⅛	5 11 2
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	12½— 13½	13 — 13½	13¼	12¾	— ¼	4 8 11
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24 %	24%	20 %	20 %	30 — 32	30 — 32	31	30½	..	6 5 0
19,600	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	56 — 59	55 — 58	56½	..	—1	6 8 9
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	78 — 82	78 — 82	..	..	..	4 17 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	70 — 74	70 — 74	..	..	..	5 8 1
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅞— 1	⅞— 1	11/-	10/-	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	⅞— 1	⅞— 1	..	..	—⅛	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅝— ¾	⅝— ¾	..	..	..	5 3 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108½—110½	108½—110½	109⅝	109½	..	5 8 7
5,725,000	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	116½—118½	116½—118½	117½	117	..	5 1 3
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½— 11½	10½— 11½	..	..	..	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10½— 11½	10½— 11½	..	..	..	4 8 11
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 1/16— 5 3/16	5 1/16— 5 3/16	5 3/16	5 1/16	..	4 7 1
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	..	..	..	3 10 4
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	6¼%	7 %	7 %	8 %	1⅛— 1⅜	1⅛— 1⅜	..	..	..	5 16 4
50,000	Do. do. do, 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	..	4 %	4 %	4 %	90 — 93	90 — 92	90½	..	— ½	4 7 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 4
11,889	Reuter's	8	5 %	5 %	5 %	5 %	7 — 8	7 — 8	..	..	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	4 7 10
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	127	..	..	4 12 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅝— 7⅛	6⅝— 7⅛	6⅞	6⅝	..	5 16 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5½	5 5/16	5	..	4 10 11
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	Nil	2½%	2½%	1¼— 1½	1¼— 1½	25/7/8	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	7 %	12⅜— 13⅛	12⅜— 13⅛	13	12⅜	..	5 5 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
84,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	8 — 8½	7⅝— 8½	8	7⅞	— ⅛	7 7 8
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6	8½— 9½	7½— 8½	..	..	— ½	2-11 5
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101½—103½	101½—103½	..	..	..	4 16 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	8 %	9 %	9 1/16— 9 5/16	9¼— 9⅜	9 3/16	9 5/16	+ 1/16	4 16 0
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5⅔%	6⅜— 6⅝	6⅜— 6⅝	6⅜	6 7/16	..	6 4 4
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	143 —148	143 —148	..	..	..	4 2 2
295,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	20 %	3⅝— 4	3 13/16— 4 1/16	80/7½	80/-	+ 3/16	4 18 2
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16— 1 1/8	1 1/16— 1 1/8	..	..	..	3 13 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	1⅝— 2	1⅝— 2	37/6	..	..	17 10 0
63,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	2⅜— 3½	2½— 3½	55/-	50/-	— ½	10 15 4
40,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3½— 4½	3½— 4	75/-	70/-	— ½	7 10 0
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3½— 4½	3½— 4½	..	..	— ½	4 14 1
43,473	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	105 —108	105 —108	..	..	..	4 12 7
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	5½%	5½%	98½—100½	98½—100½	..	..	..	5 9 5
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	8 %	134 —136	134 —138	137½	136½	..	5 15 11
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	115 —119	116 —120	118	116	+1	4 3 4
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —109	107 —109	108½	..	..	4 11 2
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	10 17 6
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
188,301	British Electric Traction	10	6 %	8 %	Nil	Nil	1/16— 1 1/16	1/16— 1 1/16	..	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	8 %	3¾— 4	3¾— 4¼	78/9	73/9	+ ½	8 1 2
1,478,553	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	91 — 96	91 — 96	94	92½	..	5 4 0
628,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	73 — 75	73 — 75	..	..	..	6 0 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	10 %	6¼— 6⅝	6¼— 6⅝	6 3/16	..	..	7 10 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6⅜	6 — 6⅜	..	..	..	4 14 1
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	104 —107	104 —107	105½	..	..	4 4 1
208,440	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	⅜— ⅝	⅜— ⅝	..	..	..	Nil
1,016,853	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	40 — 45	40 — 45	..	..	..	8 17 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	1/16 to 1/8	1/16 to 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	2½%	Nil	Nil	..	..	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	..	..	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	68 — 73	68 — 73	..	..	..	6 8 3
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	50 — 54	49 — 53	..	..	—1	8 9 10
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	8 %	6 %	4½— 5	4½— 5	..	..	..	6 0 0
45,404	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	..	5 %	5 %	5 %	4⅝— 5⅛	4⅝— 5⅛	..	..	..	4 17 7
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
85,000	Callender's Cable Construction shares ..	5	12½%	15 %	15 %	15 %	9½— 10½	9½— 10½	9⅝	..	..	7 2 10
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5½— 5⅝	5½— 5⅝	..	..	..	5 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107½—109½	107½—109½	..	..	..	4 2 2
491,222	Cape E Trams., 1 to 491,222	1	6 %	Nil	Nil	Nil	⅛— ¼	⅛— ¼	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	12 %	1 1/16— 1 1/8	1 3/16— 1 3/8 xd	33/-	30/3	..	7 14 10
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	103 —107	103 —107	105½	..	..	4 6 11
1,898,610	Central London Railway, Ord. Stock..	Stock	4 %	4 %	4 %	3 %	65 — 67	64 — 66	65	..	—1	4 10 11
558,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	84 — 86	86	86½	—2	4 13 0
558,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	51 — 53	49 — 51	..	..	—3	3 18 5
1,480,000	City and South London Railway	Stock	2¾%	1¾%	2¾%	2¾%	32½— 33½	30½— 31½	31½	31	—1	6 14 11

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations Nov. 24th.	Closing Quotations Dec. 1st.	Business done week ended Dec. 1st, 1908. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
85,000	Crompton & Co., Nos. 1 to 85,000	£	2½%	2½%	5 %	5 %	1 5/16 — 1½	1 5/16 — 1½	..	..	..	10 0 0
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	98 —101	98 —101	..	..	..	4 19 0
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 5/8 — 1 13/16	1½ — 1⅝	..	..	..	7 5 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	21/10½	..	..	5 1 1
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6%	11¼ — 12½	11¼ — 12½	..	..	..	5 4 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	2½%	4½%	4½%	4½%	¾ — ⅞	¾ — ⅞	..	..	..	16 12 6
17,139	Do. "A" shares, 01—017,139	5	2½%	4½%	4½%	4½%	1½ — 2⅜	1½ — 2⅜	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	76 — 79	76 — 79	..	..	..	5 1 3
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	86 — 89	86 — 89	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	4 %	Nil	Nil	Nil	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	..	..	..	9 6 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	6⅞ — 7¼	6⅞ — 7¼	..	..	..	b 17 11
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	84 — 88	84 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	4 %	¾ — 1	¾ — 1	..	..	..	5 0 0
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10¼ — 10⅝	10¼ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103	102 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	10⅝ — 11⅛	11 — 12	..	..	+ ⅛	6 5 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	107 — 109	105 —107 xd	..	..	..	4 4 1
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	5 %	10%	10 %	10 %	16⅝ — 17⅜	16⅝ — 17⅜	..	..	..	8 1 7
37,500	†Liverpool Overhead Railway, Ord.	10	1½	Nil	Nil	½	1 — 1⅛	1 — 1⅛	..	..	..	4 7 6
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4 — 4⅛	4 — 4⅛	..	..	..	11 2 3
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	3 %	3 %	3 %	6⅝ — 6¾	6⅝ — 6¾	..	..	..	4 8 11
999,980	Do. do. 50,008 to 100,000	10	6 %	3 %	3 %	3 %	6⅝ — 6¾	6⅝ — 6¾	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	4⅜ — 5⅛	4⅜ — 5⅛	5 1/16	..	..	9 1 10
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 72	67 — 72	..	..	..	5 11 1
5,782,062	Metropolitan Consolidated	100	3 %	2½%	1 %	½%	36 — 37	35 — 36	36½	35½	—1	1 8 6
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	67 — 69	67 — 69	68	..	..	3 19 9
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	12⅛ — 13	12⅛ — 13	13⅛	12⅜	..	Nil
814,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	Nil	3/32 — 5/32	3/32 — 5/32	1/-	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	2/- — 2/6	2/- — 2/6	16/6	..	..	5 19 5
823,800	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	92 — 95	93 — 96	..	..	+1	4 13 9
245,500	Potteries E. Tro.	1	5 %	4 %	4 %	4 %	⅛ — ¼	⅛ — ¼	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅛ — ¼	⅛ — ¼	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	90 — 93	90 — 93	..	..	..	4 14 9
37,850	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	32 — 34	31 — 33	32½	31½	—1	6 7 4
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101½ —103½	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	92½ — 93½	93 — 94	93⅜	93½	+ ⅛	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	..	7⅛ — 76	74 — 75	74⅛	74	—1	..
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	23 — 24	19½ — 20½	19½	..	—3½	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	Nil	Nil	10 %	2 3/16 — 2 5/16	2 3/16 — 2 5/16	1/-	..	..	10 0 0
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	Nil	Nil	..	6 %	2 3/16 — 2 5/16	2 3/16 — 2 5/16	52/6	..	..	10 8 8
246,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	70 — 74	68 — 72	72½	69½	—2	5 11 1

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	£	5¼%	5½%	5½%	6¼%	4⅜ — 4⅞	..	..	..	..	5 11 5
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 98	94 — 98	..	..	..	4 10 0
30,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	7⅞ — 8	8⅛ — 9	8⅞	7⅞	+1⅛	5 11 1
9,725	Do do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞ — 8	8 — 8⅛	7⅞	..	+ ⅛	4 2 4
886,676	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 — 102	99 —101 xd	..	..	..	3 19 3
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	4⅛ — 4⅜	4⅛ — 4⅜	98/9	88 9	+ ⅜	5 5 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 — 4⅛	4⅛ — 4⅜	86/3	83/9	+ ¼	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	4⅛ — 4⅜	83/9	..	+ ⅜	5 16 2
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	..	..	..	4 1 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	3 — 3⅛	4 — 4⅛	87/6	65/-	+1	5 0 0
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —103	101 —104	..	..	+1	4 6 7
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9⅜ — 10⅛	10⅛ — 10⅜	10½	..	+ ⅛	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	15⅛ — 16	12⅛ — 13	12⅝	12½	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	123 —125	123 —125	..	..	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	£3 7 0	4 %	4 %	2 %	2¼ — 3	2¼ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3⅝ — 4	3⅝ — 4	..	..	..	6 5 0
210,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	..	99 —101	99 —101	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	7⅝ — 8⅛	8⅜ — 9⅛	8⅝	8⅜	+1	5 11 1
50,026	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅛ — 11	10⅜ — 11½	10⅜	..	+ ⅛	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	97 —100	97 —100	99⅜	..	..	4 10 0
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4 %	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	Nil	⅛ — ¼	⅛ — ¼	16/3	..	..	Nil
480,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	62 — 65	62 — 65	..	..	..	6 18 6
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	..	84 — 86	84 — 86	85	84½	..	..
10,000	Folkestone, 1 to 10,000	5	5¼%	5½%	5½%	5½%	4½ — 5⅛	4½ — 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 11
15,000	Hove, 1 to 15,000	5	8½%	9 %	9 %	8½%	1⅛ — 1½	1⅛ — 1⅝	..	..	+ ⅛	6 10 9
$1,325,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	..	95 — 96	95 — 96	..	..	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	10 %	7⅝ — 8⅜	7⅝ — 8⅜	8	7 13/16	..	6 5 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
111,000	London Electric Supply Corporation, Limited, Ord.	3	3 %	4 %	4 %	2½%	1 — 1⅛	1⅛ — 1⅜	35/-	31/3	+ 1/16	4 0 0
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅝ — 5⅛	4⅝ — 5⅛	97/6	..	+ ⅛	5 14 3
374,898	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4½%	4½%	90 — 93	91 — 94	..	..	+1	4 15 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6½%	5⅛ — 5⅜	5⅜ — 5⅝	5 1/16	5⅛	+ ⅛	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 4⅞	4⅝ — 5⅛	..	..	+ ⅛	4 3 9
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	106 —109	107 —110	..	..	+1	4 1 10
248,000	Do. 5% Mort. Deben. Stock Redem.	Stock	5½%	5½%	5½%	5½%	85 — 88	85 — 88	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	86 — 87	86 — 87	86	..	..	5 14 11
$18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	..	76 — 77	76⅞ — 77⅛	77⅛	76⅞	..	..
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	..	107⅛ —109	106⅛ —108	108⅛	107	—1	..
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	..	89½ — 90½	89½ — 90½	90⅛	89½	..	..
£50,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	7 16 1
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
10,855	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11⅜ — 12⅜	11⅜ — 12⅜	..	..	..	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6⅛ — 6½	5⅞ — 6⅛	..	..	..	5 12 0
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	..	2½%	..	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	6	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	..
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	5	..	100 —103	100 —103	101⅛	..	..	4 17 1
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7⅞ — 8⅛	8⅛ — 9⅜	9⅛	8½	+ ⅞	5 12 8
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	4 13 4
150,000	Do. do. 3¾ % Deb. Stock Red.	100	3¾%	3¾%	3¾%	3¾%	87 — 91	87 — 91	..	..	..	3 16 11
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2½ — 2⅝	2½ — 2⅝	..	..	+ 1/16	6 19 2
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	3/32 — 5/32	3/32 — 5/32	..	..	+ 1/32	3 6 8
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	1⅛ — 1⅜	28/9	..	+ ¼	5 16 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	99 —102	100 —103	..	..	+1	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅞ — 1	⅞ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅝ — 2	1⅝ — 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 83	80 — 83	..	..	..	5 8 5
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	3/32 — 5/32	3/32 — 5/32	12/6	..	+ 1/16	..
110,000	Westminster Electric Supply, Ord.	5	14 %	18 %	12 %	10 %	8 — 8¼	8⅝ — 9⅛	9⅛	8⅝	+ ⅜	5 11 1
81,279	Do. do. 4 % Cum. Pref. Reduced from 5% since 31st Dec., 1905	5	5 %	5 %	4½%	4½%	5 — 5⅛	5⅛ — 5⅜	5 1/16	..	+ ⅛	4 1 10

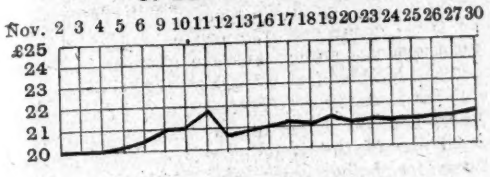
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908.

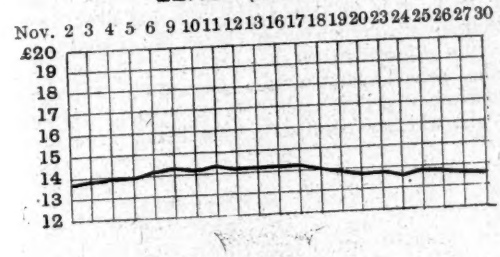
METAL MARKET.

Fluctuations in November.

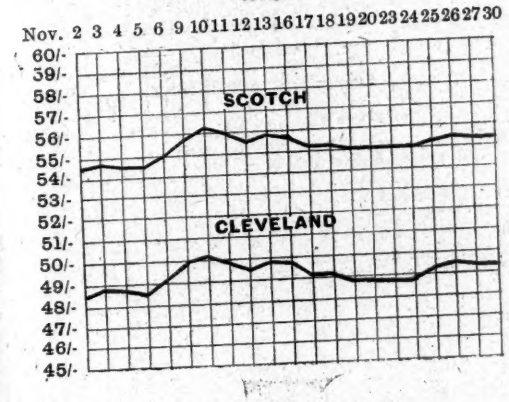
SPELTER (G.O.B's.).



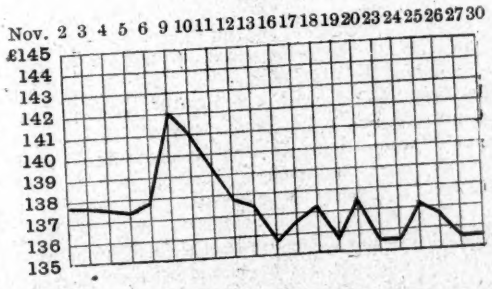
LEAD (ENGLISH).



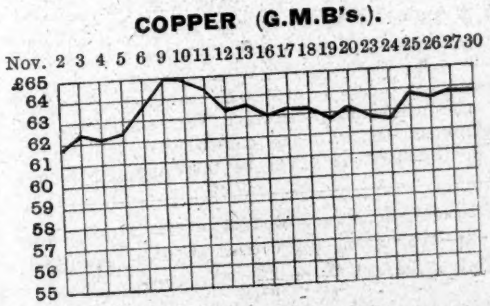
IRON.



TIN.



COPPER (G.M.B's.).



Municipal Sinking Funds.—"It is satisfactory to note," says the *Times*, "that a Parliamentary Committee has been appointed to inquire into the powers conferred on local authorities to utilise sinking funds for borrowing purposes, and into the question of the expediency of these powers and the desirability of attaching conditions to them. The Committee consists of Messrs. Ashton, Fenwick, Harmood-Banner, Masterman, and Charles Nicholson. Recent experiences have shown that the question of the application of municipal sinking funds requires constant vigilance."

ELECTRICITY FROM REFUSE.

We seldom hear much of this subject nowadays; yet, at the Cambuslang Electricity and Destructor Works, it seems that it is more than a mere phrase. The following figures, which were sent us some time ago by the electrical engineer, Mr. A. J. Abraham, show that during December, January and February last the proportion of coal used was infinitesimal:—

Week ending	Total units generated.	Units gen'd from refuse.	Units g-n'd from Coal.	Refuse destroyed.	Coal used.	Wages cost per ton of refuse destroyed.	Cost of coal.
				T. C. Q.	T. C.	s. d.	£ s.
7/12/07	3,261	3,114	147	93 2 2	1 2	1 1	0 11
14/12/07	3,409	2,956	453	105 4 1	2 14	0 11¾	1 7
21/12/07	3,591	3,315	276	107 6 3	2 2	0 11½	1 2
28/12/07	3,531	3,531	None	90 6 2	None	1 1¼	—
4/1/08	3,622	3,107	515	86 8 1	2 8	1 2	1 4
11/1/08	3,441	3,365	76	121 13 0	0 12	0 9¾	0 6
18/1/08	3,283	3,283	None	105 0 0	None	0 11¾	—
25/1/08	3,176	2,763	413	106 1 3	2 8	0 11½	1 4
1/2/08	2,965	2,965	None	101 3 2	None	1 0	—
8/2/08	2,797	2,797	None	96 9 0	None	1 0½	—
15/2/08	2,667	2,340	327	99 5 2	2 2	1 0	1 1
22/2/08	2,468	2,468	None	100 16 0	None	1 0	—
29/2/08	2,350	2,350	None	105 15 1	None	0 11½	—
Total ...	40,561	38,364	2,207	1,318 12 1	13 8	1/- per ton Average	6 15

The wages cost per ton includes not only the wages of the stokers and men actually burning refuse, but also the cost of weighing it. Trouble was experienced all December by stokers leaving or being dismissed. During March, April, May and June no coal at all was used, except for a few hours each month when they shut down for flue-cleaning; so Mr. Abraham has not picked out the most favourable figures.

The coal used includes the coal wasted in getting up steam from a cold boiler.

For the year ending May 15th, 1908, the works generated 103,580 units—88,699 by refuse and 14,881 by coal—and destroyed 3,670 tons 17 cwt. 3 qr. of refuse. Mr. Abraham hopes to get through this winter without using coal, except for flue-cleaning.

NEW APPARATUS FOR WAVE-FORMS.

Up to the present time the oscillograph has been the only practical instrument in use for obtaining a direct projection of current waves upon a screen. One of the principal disadvantages of the oscillograph is that the image of the waves is a comparatively small one; for lecture purposes, or for making measurements on the curves, it would be preferable to have the waves represented on a screen in a much larger form. This result is now secured in a new instrument which has been devised by M. Abraham, a prominent physicist of Paris, who has had considerable experience as an assistant to Prof. Blondel in his work on the oscillograph. M. Abraham has succeeded in making an instrument which is much simpler and less expensive than the former instrument, and, moreover, it occupies a smaller space.

The instrument, as constructed at the Carpentier establishment, consists of two distinct parts. One of these is a special form of galvanometer, which contains a swinging mirror, and this is made to follow all the variations of the current. The mirror swings back and forth, and would trace only a line of light upon the screen, were it not for the fact that a second apparatus is interposed between the mirror and the screen, which serves to spread out the light coming from the mirror, so as to give the form of the wave upon the screen.

The action of the galvanometer will be understood from the accompanying figures. Suspended by two wires is a light aluminium frame I of rectangular shape, carrying in the centre a concave mirror which measures 6 × 8 mm., and is

consequently of a much larger size than is used in the oscillograph (fig. 1). The aluminium frame is made to swing rapidly under the influence of the current. Around the frame is fixed an E-shaped piece of laminated iron P, which is provided with a covering piece F of the same

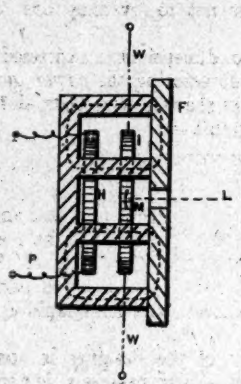


Fig. 1.

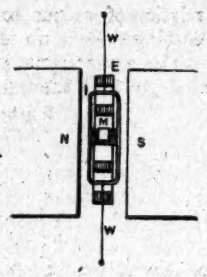


Fig. 2.

metal, so as to form a closed magnetic circuit. Upon the same iron core, and lying next to the aluminium frame, is mounted a small rectangular coil of wire H, which is fixed, and is so disposed that when a current is passing in it the resulting magnetic flux will take the path which is shown by the dotted lines. The entire device, as shown in section in fig. 2, is mounted between the poles of a permanent magnet

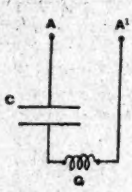


Fig. 3.

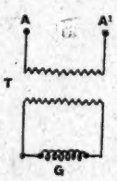


Fig. 4.

N S. Should there be no current passing in the coil, the flux in the iron core will take a transverse direction in the latter.

The construction of the galvanometer allows of the production of induced currents in the swinging frame I in such manner that the movement of the latter will follow exactly the variations of the current to be observed. In order to obtain this result an intermediate current is produced outside

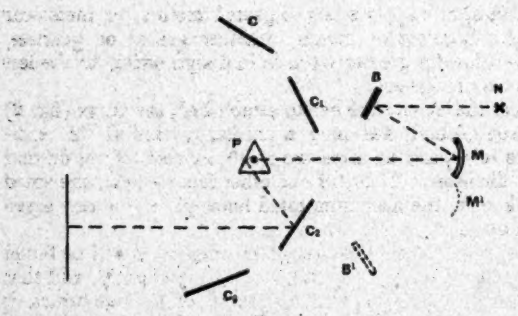


Fig. 5.

of the instrument, which is in quadrature with the current (or electromotive force) to be observed. In the case of an electromotive force, a condenser is disposed in series with the galvanometer, as seen in fig. 3, and the whole is placed on the main circuit A A^1. For taking the current wave, on the other hand, the current is passed through the primary coil of a small transformer whose secondary coil is closed upon the galvanometer (fig. 4). In practice two separate galvanometers are used, and these are placed side by side, so as to throw the two waves upon the screen. The intermediate current is thus sent into the fixed coil of the galvanometer, and this coil acts as the primary of a small transformer, whose secondary consists of the short-circuited aluminium frame. Were the permanent magnet not used in this case, the result would be a simple attraction of the frame toward the coil, without a rotation of the former. By employing the transverse flux from the permanent magnet, acting together with the flux which the coil tends to set up in the core, we have a resultant action which causes the coil to rotate about its axis, producing a deflection of the beam of light from the mirror. Under these conditions, the coil is made to follow all the variations of the original electromotive force or current.* In this way M. Abraham realises a galvanometer which can be used for instantaneous currents, and at the same time will carry a much larger mirror than usual, owing to the increased size of the swinging part, and this gives a great advantage for photographic work or projection. In order to project the beam upon the screen, an arc lamp is employed, and the light is sent upon the swinging mirror by a large reflecting mirror which is mounted on the apparatus, and can be adjusted for this purpose.

The second part of the apparatus, known as the "synchronoscope," is used in order to spread out the beam of light which comes from the oscillating mirror, so as to

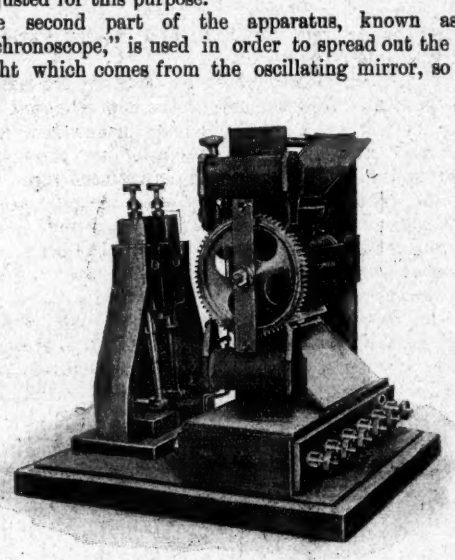


Fig. 6.

give the wave form upon the screen. This movement is proportional to the period of the wave. In fig. 5 is shown the principle of the synchronoscope. The two galvanometers, one for the current, and the second for the electromotive force, are mounted side by side on the right, and their mirrors are represented at M M^1. The mirror M receives a beam of light from an arc lamp by means of the adjustable mirror B which is fixed to the frame of the apparatus. This beam is reflected to the left, and passes through the synchronoscope before reaching the screen. A revolving prism lies at the centre of the synchronoscope, and receives the two beams (the second beam coming from the mirror M^1 in the same way). The prism is totally-reflecting, and is caused to rotate rapidly in synchronism with the wave by means of a toothed wheel of soft iron, which is mounted so as to rotate between the poles of an electromagnet; the latter is connected to the source of current, and this combination makes a very simple and effective synchronous motor. Its construction will be seen in fig. 6. Should the prism be revolving, and the mirror

* The equation for the movement of the swinging frame is as follows:—The intermediate current given by the special transformer is of the form $\frac{de}{dt}$ or $\frac{di}{dt}$. The current induced in the aluminium frame has the form $\frac{d^2e}{dt^2}$ or $\frac{d^2i}{dt^2}$. Accordingly, the equation of the movement of this frame (in the case of a current i to be observed) is $A\frac{d^2\theta}{dt^2} + B\frac{d\theta}{dt} + C\theta = G\frac{d^2i}{dt^2}$, where θ is the deflection and A, B, C and G are constants. It is seen that if we render negligible the two terms in $\frac{d\theta}{dt}$ and θ (which condition is realised in the apparatus), the equation is reduced to the form $A\frac{d^2\theta}{dt^2} = G\frac{d^2i}{dt^2}$; and therefore θ varies as i—that is, the angle of deflection varies with the current.

in oscillation at the same time, the combined action would cause the wave-form to appear on the screen, owing to the repeated reflections from the three sides of the prism, and the latter would, therefore, give three reflections of the wave per revolution. But it is further desired to increase the number of reflections in order to secure a better image upon the screen. In order to carry this out, the light which comes from the prism is not sent directly upon the screen, but is further reflected by a set of fixed plane mirrors which are disposed round the prism. These mirrors are placed so as to be about tangent to a parabola at whose focus is placed the centre of the prism, and they are shown at C C_1 C_2 C_3. During the rotation of the prism, the beam from each of its faces is reflected upon the four mirrors in succession, and at each reflection the curve is thrown in the same place upon the screen, so that for one revolution of the prism there are 12 successive projections of the wave on the screen. In practice, the wave is thus traced as a continuous line of light, and the electromotive force and current waves have their proper relative positions.

The projection lantern which contains the arc lamp N is placed about 2 ft. from the axis of the apparatus and somewhat in the rear, so as to light the two plane reflectors B B'. The mirrors M M' of the galvanometer are then slightly inclined upwards by means of an adjustment screw which moves the part of each galvanometer lying between the magnet poles as a whole. This adjustment brings the beam of the mirror into a horizontal direction. The prism is then placed so as to give the image of the arc upon the screen, and as the galvanometer mirrors have about 3 ft. focus, the screen can be placed at 9 ft. distance, and the focusing is effected by shifting the arc lamp. The motor is designed to work properly at any frequency of the current, within the usual limits. Different curves, such as oscillating discharges, &c., can be obtained by the instrument.

FEATURES OF CONTINUOUS-CURRENT RAILWAY MOTOR DESIGN.

By E. V. PANNELL.

The practical application of the electric motor to the propulsion of railed vehicles was commenced in the early eighties. The traction motors of that date were simply the shunt-wound bipolar machines in common use for stationary purposes. Naturally this adaptation of unsuitable machines led to considerable trouble in the way of burn-outs due to overloads and mechanical difficulties consequent upon the high rotational speeds and inadequate forms of suspension. The pioneer work of such engineers as Sprague, Short and Van Depoele resulted in the evolution of the railway motor into a standard design very little removed from that which is common to-day. Briefly, it may be said to be a series-wound four-pole medium-speed motor, totally enclosed in a cast-steel carcass and geared to the axle by single reduction gearing.

Up to the year 1895 there was no definite standard of motor rating. Purchasers of traction motors put them into service, relying solely on the reputation of the manufacturers. With the appearance of the GE 50 in 1895, the makers (the General Electric Co., of Schenectady, N.Y.) introduced the "one-hour" basis of rating, on which the motor is rated on the horse-power it will develop for a period of one hour with a temperature rise of 75° C. on the hottest accessible part. This method of rating was standardised by the Am.Inst.E.E., and has since been universally adopted. It affords a ready basis for comparison of different makes, and is useful as a test of the commutating qualities of the motor.

The design of railway motors differs from that of stationary electrical machinery in the direction of the different limiting factors in either case. It is usual in the design of continuous-current machinery to consider the dimensions as subservient to the two requisite features of good commutation and low cost; and to so choose them as to effect the best compromise, at the same time keeping in view the tertiary consideration of heating. With a railway motor designed to work between the wheels of a standard gauge railway coach, the limiting dimensions are absolutely fixed. The heating, too, is limited by the rating basis. At the higher outputs, therefore, all the skill of the designer has to be exercised in order not to overstep one of these limits.

The relation of output to dimensions is expressed by the output coefficient—a term representing the power generated by unit volume of material in the armature body at 1 R.P.M. Its value is given by the formula—

$$\frac{\text{Watts output}}{D^2 \lambda_g \times \text{revs. per min.}},$$

D and λ_g being respectively the armature diameter and gross length over laminations. From fig. 1 it will be seen that this quantity approaches values considerably higher than are reached with stationary motor designs. This is partly due to the basis of rating, and partly to the more rapid approach of $D^2 \lambda_g$ to a finite limit.

The space at the disposal of the designer is absolutely limited in the axial direction, and transversely, is dependent

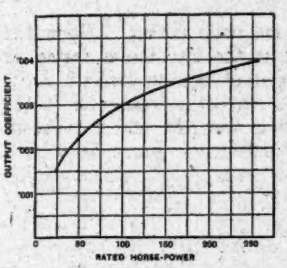


Fig. 1.—Output Coefficients for Railway Motors.

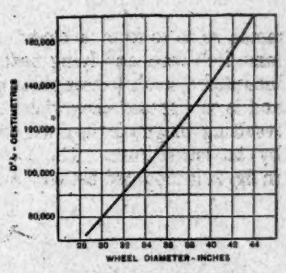


Fig. 2.—Maximum Values for $D^2 \lambda_g$ with Different Diameters of Driving Wheel.

on the driving wheel diameter. The axial length between wheels varies from 48 to 51 in. Making suitable allowances for width of gears and length of commutator (for motors of the order of 200 H.P.) the maximum possible core length is deduced at 15 in. (38 centimetres).

The armature diameter is limited by the size of driving wheel which can be run under the car body. It is usual to allow a clearance of not less than 3 in. between the rail level and the bottom of the motor casing, and to slightly tilt up the motor towards the truck bolster. Under these conditions it is found that the height of the motor casing approaches 85 per cent. and the armature, 60 per cent. of the wheel diameter.

These figures apply solely to geared motors for motor-car service. Locomotive motors, whether geared or gearless, usually allow for greater latitude in design owing to the less restricted dimensions.

From the conclusions hereto established, the curve (fig. 2) has been plotted, assuming a constant value of 38 centimetres for λ_g and an armature of 60 per cent. of the driving wheel diameter. Hence if one other factor—viz., the speed—be known, the maximum rated horse-power for any given wheel diameter can be determined.

Throughout the whole range of outputs it will be found that the speed at rated load varies very slightly, and that the figure of 550 R.P.M. represents an average which is departed from to a very small extent. The allowable peripheral velocity may be said to increase with the rated output at the same rate as the armature diameter—hence there is nothing illogical in the constancy of the speed, whatever the output.

The author must confess to a certain conservatism in regard to rotational speeds. It is true that certain Continental railway motor designs run with rated speeds of 700-750 R.P.M., but bearing in mind that the light-load speed exceeds this by at least 100 to 150 per cent., apart from the possibility of wheel-slipping, and that flashing-over troubles are aggravated with increasing speed, it will be seen that—other things being equal—the lowest speed represents the best design.

The figure of 550 R.P.M. well represents British and American practice in this direction. A direct relation

between rated output and $D^2 \lambda_g$ can now be established for the reference speed of 550 R.P.M., and for what may be considered the upper and lower limits of 700 and 400 R.P.M. (fig. 3).

The total weight in metric tons is plotted as a function of the rated output in fig. 4. The weight per horse-power will be seen to decrease asymptotically with increasing output, due to the better specific utilisation in the larger motors.

Sufficient data for the estimation of dimensions being now available, it remains to balance up the field and armature components of the output. The fundamental output formula is :—

$$\text{Watts} = \cdot 04 \; A \, T \sim M.$$

A T is the ampere loading of the armature, the product of the total number of turns with half the rated current. The periodicity is given by $\frac{\text{R.P.M.}}{30}$ for a four-pole motor M, the remaining factor represents the flux per pole in megalines. As a rule, the magnetic circuits of railway motors are run at very high degrees of saturation, thus to a great extent preventing distortions and at the same time utilising the

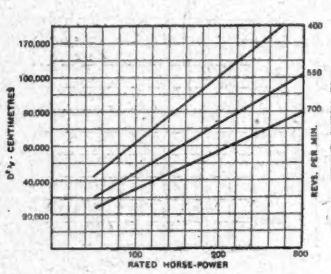


Fig 3.—Values of $D^2 \lambda_g$ for Different Rated Outputs and Speeds.

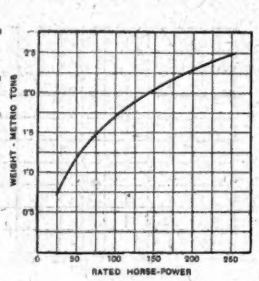


Fig. 4.—Weights of Railway Motors (Excluding Gears).

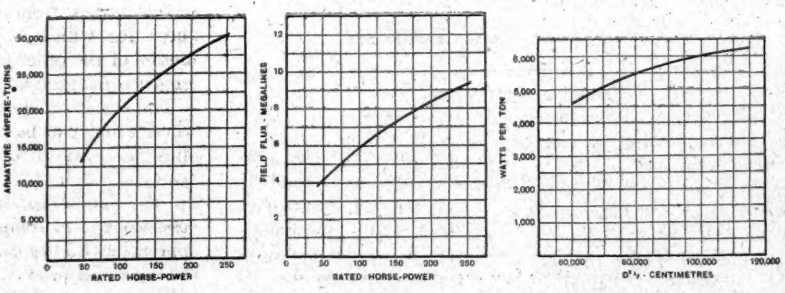
magnetic material to its maximum capacity. The effect of saturation on the speed curve has been illustrated by Mr. Hobart ("Electric Motors: Their Theory and Construction"). The hypothetical unsaturated motor being characterised by a rectangular hyperbolic speed curve, while the opposite extreme gives a constant speed independent of current input.

Saturation has the effect of making the torque approach a linear function of the current instead of a quadratic function.

Although the armature strengths expressed in armature ampere-turns per pole vary from low to medium values, the armature loading, due to the limited diameter, is usually fairly high. The ampere-conductors per centimetre of periphery vary from 300 to 400. Large slots and strip conductors combine to give space factors of the order of 0·5, while the conditions of the one-hour rating allow current densities of 400 to 450 amperes per square centimetre. Representative values for magnetic and armature loadings are plotted in figs. 5 and 6.

The type of armature winding adopted is invariably the series or two-circuit. It requires only two sets of brushes, and has the advantage of neutralising any unbalanced effect due to inequality of air-gap. The number of turns per segment is limited by the allowable reactance per coil, and varies from 6 in the smallest tramway motors down to 1, which latter is common for all railway motors of 100 rated horse-power and upwards.

Even with one turn per segment, the commutating constants steadily grow worse with increasing output. Dimensions being limited, there is no remedy but the adoption of commutating poles, which is gradually being resorted to by the principal manufacturers. This construction involves no increase of weight, and considering that the largest motors on the market are operating with about 9 reactance volts per segment, some such neutralising device would seem to be justified.



Figs. 5 and 6.—Values for Armature Loading and Flux per Pole.

Fig. 7.—Ratio of Losses for Different Values of $L^2 \lambda_g$

The question of heating is one to which, owing to the established method of rating, all other designing considerations are subservient. At its rated load the motor is designed to be capable of absorbing a definite number of watts lost due to copper, core and commutator losses, the result of which is to raise its temperature through 75° C. in one hour's running. Inasmuch as the one-hour run takes place with covers removed, a certain amount of radiation can, and does, take place. Neglecting this, the motor may be considered as an insulated body of known mass and unknown specific heat, raised through a definite temperature by a definite amount of energy expended in its interior.

That it is a question of mass, and not as in open-type machines, one of superficial area available for dissipation, was first recognised by Mr. H. M. Hobart, who introduced the "watts per ton weight" expression as an indication of the thermal performance.

The curve in fig. 7 is prepared from data of modern railway motors of 100-250 rated horse-power. By plotting as a function of $D^2 \lambda_g$ account is taken of the better radiation per unit weight with decreased density of the motor volume taken as a whole. The distribution of the losses varies with the load. At rated load, speed and core losses are low, and the field $I^2 R$ is the limiting factor, causing the maximum temperature to be recorded on the field winding. At higher speeds the $I^2 R$ decreases, but armature core loss causes the armature temperature to predominate in spite of the better ventilation.

Much has been written on the heating of railway motors in service, and it is still a subject on which it is impossible to generalise. One thing may be regarded as certain, however, that with increased severity of service forced ventilation will become common.

The design of motors for locomotive service, while following the general lines set out above, is generally a more simple problem. As a rule, geared locomotive motors are heavier and bulkier for their output than those designed for motor-car service. Hence more space in their interior can be utilised for ventilation, and the capacity for continuous service thereby increased. Gearless motors have not crystallised down to a standard design sufficiently to generalise upon. The most recent examples, however, provide much that is instructive, and seem to indicate the direction of future progress in high-speed railway work.

REVIEWS.

Elementary Manual on Applied Mechanics. By Andrew Jamieson, M.Inst.C.E. Eighth edition, revised and enlarged. London: Charles Griffin & Co., Ltd. Price 3s. 6d.

This is the last edition of Prof. Jamieson's well-known work, and does not differ in any great detail from its immediate predecessors.

The 1907 Examination Papers for Stage I of the Board of Education; the City and Guilds of London, Ordinary Grade, Part I, Sections A and B on Mechanical Engineering; and the Entrance, or Students', Examinations of the Insti-

tution of Civil Engineers for 1907 and 1908, have been added to Appendix B. At the end of Lecture I a new page has been inserted. It deals with the terms and definitions of words used in measuring pressures, and contains a discussion of the recent endeavours by some authors to introduce the words thrust and resultant thrust. We are altogether with the author in this matter. The substitution of the word thrust for total pressure is in no wise an advantage as far as students are concerned. The most important point to remember is the necessity of employing accepted terms in their correct sense. In how many books on Mechanics do we see such things as force and power spoken of as being identical!

Needless to say, the work before us is quite free from such ambiguity.

At the end of Lecture XVIII, half a page has been inserted giving concise distinctions between solids, liquids and gases, with definitions of perfect, viscous and elastic fluids. In Lecture XXVIII, on measuring tools, the portion dealing with limit gauges has been largely re-written. The construction and application of Berridge's tangentometer has also been considered. This little instrument is of the greatest use to students in finding the trigonometrical functions of angles, in a practical way.

The author has also added to Appendix C the latest and most correct set of definitions for the nomenclature, with their abbreviations or symbols, of the C.G.S. and of the authorised practical electrical units.

Taking it as a whole, the book stands in the premier position as a text-book for elementary students. It employs a mixture of theory and practice (which is acceptable, though imperfect) and uses well-drawn diagrams and excellent illustrations. There are none of the crudities present throughout its 450 pages that blemish the works of writers who know nothing of the art of teaching; and as before mentioned, no ambiguous terms are used.

We think that a chapter should be inserted at the commencement, giving the algebra used in the various problems.

The theory of similar figures should be gone into in an elementary way, in order to render a student able to grasp their frequent application in applied mechanics. Nine out of ten elementary students come to grief over a couple of similar triangles. The chapter on Inclined Planes could be improved a little. The diagrams of forces applied parallel to the plane, parallel to the base, and at any angle, are somewhat complicated; we would separate the force diagrams from the inclined-plane figures. We think, too, that some simple experimental methods should be given in this chapter on the practical determination of these forces.

Too much is given on the subject of beams for an elementary manual. What is wanted is less theoretical and more practical work. Unless, when dealing with beams, a student is *compelled* to work with practical examples, he never of his own accord touches them.

Nowadays, in all technical schools worthy of the name, students are taught mechanics both in the lecture room and in well-fitted laboratories, for the simultaneous imbibing of theory and practice is indispensable. The want of a book for beginners that judiciously mixes up the theory and practice has long been felt.

The book under review comes nearer the desired end than any other, but a nearer approach is still necessary. Just a little less theory and a little more practice.

The Gas Engine Manual. By W. A. Tookey. London: Percival Marshall & Co. Price 3s. 6d. net.

While Mr. Tookey's earlier works: "Gas Engines, Their Advantages, Action and Application," and "Oil Engines, Their Selection, Erection and Correction," were elementary, and intended to be most useful to attendants and others having little or no technical knowledge, the present work is of a more advanced and comprehensive order, intended to assist practical engineers engaged in the construction and management of internal combustion engines.

Although the subject matter is confined to a study of the working principles of the ordinary industrial gas engine of the four-stroke or "Otto" cycle type, and governed upon the hit-or-miss principle, no special make or type of gas engine is exploited; the reader is given the benefit of the author's independent and extensive experience with engines as installed for various power applications by the numerous manufacturers. A careful perusal of the Manual will make it evident that although an installation, as handed over by the manufacturer, may fulfil the claims made as to economy and efficiency, a certain amount of special knowledge is required to maintain the machine in first-rate and satisfactory running condition; any disturbance of the ignition gear, through wear or other cause, the wearing down of a cam, &c., seriously affect both the running and the efficiency of an engine.

While failure of the ignition, and some other defects, result in a complete stoppage of the gas engine, there are certain conditions which bring about premature ignition, back-firing, and increased consumption of gas, with a corresponding falling-off in power. The application of an indicator not only, in some cases, prevents a stoppage from occurring through some defect, but also, in a graphic manner, shows whether all the functions of the engine are being performed effectively, and Mr. Tookey has made the explanation of *good* and *bad* diagrams a special feature of this work, as illustrated by actual diagrams taken in different installations.

After an introduction giving a synopsis of the history of the gas engine, the work is divided up into eight parts:—

I. The Induction Stroke. II. The Compression Stroke. III. Ignition and Expansion. IV. The Exhaust Stroke. V. Gas Engine Efficiencies. VI. Water Circulation and Valve Settings. VII. Indicating. VIII. Power Gases. Each part is further divided into special sections.

A large amount of most useful information is condensed into the 186 pages, explained in the author's usual clear, and not too technical, style, and is illustrated by over 100 diagrams and views. There is hardly a point in connection with the installation and running of the ordinary industrial gas engine which is not fully treated in the Manual, and it is equally useful to the proprietor and the ordinary attendant, while the price is well within the reach of the latter.

Electrical Engineering. By W. Slingo and A. Brooker. London: Longmans, Green & Co. Price 12s. 6d. New edition.

This large and well-known treatise, which has been before the electrical public for over 18 years, now consists of 17 chapters and 833 pages, and its scope includes such things as units, primary batteries, dynamos, motors and transformers, arc lamps and installation equipment.

The book has again been thoroughly revised, but there is still a good deal in it which might well be omitted. For instance, on page 8 in discussing the current flow from a cell due to a difference of potential, the earth, its capacity and its charge are introduced in an unnecessary and confusing manner.

The chapter dealing with condensers seems rather mixed, units, &c., being pitch-forked into it, as on page 52: "A square centimetre is the area contained in a square, each of whose sides is one centimetre," and so on.

Chapter III, on Primary Batteries, contains descriptions of obsolete cells. Other things which might well be omitted are the De Meritens and other antiquated dynamos, such as the Brush and Thomson-Houston arc-lighters, and the very old diagram on page 403 has no bearing on dynamo design.

Everything in the book is, of course, treated without the use of mathematics, and it seems to the writer that the information being only of a descriptive character, the explanation just stops short at the crucial point. After dealing with reflection from wall surfaces the authors state:—"The student will not be surprised to learn that while one room may be well lighted with an expenditure of three-quarters of a watt per square foot, another room will be but dimly lighted with an expenditure of 1½ or 2 watts," or words to this effect. What have the watts per foot to do with it?

On page 291 the authors state that "coercive force . . . is the principal factor in determining the amount of energy lost by hysteresis." On page 460 the ordinary erroneous method of determining hysteresis loss in armatures is referred to. On page 461 the authors state that Mr. Steinmetz *has shown by experiment* (the italics are the writer's) that hysteresis loss $= v\,a\,n\,B^{1\cdot6} \div 10^7$ watts. It is well known, however, that Mr. Steinmetz used Prof. Ewing's experimental results to plot his log curves from. The authors should explain that such a law does not apply to dynamo armatures at all, or else they should give its limitations. On the same page the authors also state: "We might also expect that the "hysteresis loss would vary directly with the value of B," and then go on to explain that it does not do so as above. Why anyone should imagine that the loss should vary directly as B, they do not explain. Previously the student had read that it depended largely on "coercive force."

The book, however, contains a great deal of descriptive matter doubtless interesting to elementary students, who probably will not examine it too closely.

Its popularity is evidenced by the numerous editions through which it has passed, and while it is not free from errors and inaccuracies, we have no doubt that its easy style, clear illustrations, and periodical revisions will enable it to maintain its place as a popular elementary text-book for many years to come.

Laboratory and Factory Tests in Electrical Engineering. By G. F. Sever and F. Townsend. London: Constable and Co. Second edition. Price 10s. 6d. net.

This work is intended to serve as a text-book for the use of students, and may be useful to those engaged in practical work. It consists of some 262 pages, and is divided into three portions, viz., direct-current tests, alternating tests and electrical measurements.

It begins with advice as to sending in reports and general directions for operating machines. Amongst the latter, one reads that "a bearing is getting too hot, when you can no longer hold your hand on it."

Amongst the symbols one notices F = magnetomotive force in Gilberts, ϕ = magnetic flux in Webers, and R = magnetic reluctance in Oersteds, T = torque in ft.-lb., although lb.-ft. is generally used here. Regarding these symbols, doubtless, there is a class of people to whom names and symbols are absolutely essential, although to the writer it seems to matter little whether one refers to "ohms" or "resistance" in units, and represents it by A, R, Z, or omega. By and by, doubtless, we shall have a beautifully complex system of names for units of ampere-turns, &c., and tables for converting one set into the other, a species of mental gymnastics, of no earthly use to anyone.

On page 22 there is a positively unearthly diagram of an armature with volt and ammeter connected up, to illustrate fall of potential methods of measuring armature resistance, &c.

In describing the building-up of the E.M.F. in a shunt dynamo the usual statement is made that it goes on increasing till the iron is saturated. This is by no means the case; the magnetic induction is never more than 14,000 C.G.S. lines or so, per square centimetre—however, most books say "saturation."

The explanation of the shunt machine diagram on page 38 hardly appears correct, the authors stating that "the curve does not pass through zero due to the voltage caused by residual magnetism." This would make it cut the ordinate when current is zero.

On page 61 the diagram of a starting switch is very poorly done. On page 110 there is a diagram of an old Thomson-Houston arc lighter, and it seems curious to find American authors referring students to Prof. S. P. Thompson's book for further particulars.

On the whole, it may be said that there is the usual collection of tests, and we think the authors have produced quite a useful manual for students, but, of course, there are many similar ones on the market in this country.

The figures, vector diagrams, &c., are poorly printed in many cases, and on page 241 secohmmeter is wrongly spelt; if such a name is to be retained (although, by the way, this instrument is only a commutator) "secohms" ought to be mentioned in the table of symbols.

On page 232 the usual Steinmetz expression for hysteresis loss is given—viz., $\eta\,\beta^{1\cdot6}$, and it is stated that it "is not always rigidly true since the hysteresis constant η is liable to change slightly, and the value of w is not always exactly proportional to the 1·6 power of the induction." The writer thought it had been established that the 1·59 power of the induction held closely not only for iron, but, strange to say, for nickel, and cobalt also, within certain limits. Certainly the alteration in the constant could not affect the index.

The authors also state that "hysteresis measurements by comparison with a standard having a known hysteresis constant, are usually only approximate, *although the determinations of permeability made in this way are quite reliable.*" Why this should be so, the authors do not explain.

PARLIAMENTARY.

London Electric Companies' Bill.

Tuesday, November 24th, 1908.

Mr. J. B. Braithwaite, chairman of the County of London Co., called by Mr. Balfour Browne, said that the Camberwell Borough Council could purchase so much of the County of London's Co.'s undertaking at any time on payment of £133 for every £100 of stock. The City Corporation could purchase the City part of the Charing Cross Co.'s undertaking in 1914. The rights of those two local authorities were protected. The companies had foregone, to some extent, compensation which they would have got if the local authorities had remained the purchasing authority, as they would then have received payment for severance. He thought it was only fair that the arbitrator, when considering what should be paid to the companies, should consider it on "equitable terms."

Counsel: Would you have promoted this Bill at all if those concessions were not conceded?—They would not have agreed to the instruction. They would not have brought forward the Bill unless the concession of "equitable terms" had been granted them.

Continuing, Mr. Braithwaite said it was a reasonable thing to ask for 10 years' notice of purchase. It was in the interests both of the companies and of the L.C.C. The clause stating that the award was to be based on equitable terms was for the protection of their debenture-holders. In his opinion the clauses put in by the L.C.C. prevented consolidation.

Cross-examined by Mr. Freeman, Witness said they had no guarantee that the whole of their undertakings would be acquired at the same time. They would not get any compensation from the L.C.C. for severance.

The Chairman said that assuming the local authorities had all agreed to purchase at one and the same time, he would like to know whether the companies would have got any payment for severance.—Witness said that the local authorities had not got the power to purchase at the same time. All the companies wanted to do was to help the consolidation of the period of purchase.

Further cross-examination, Witness said that in the companies' new clauses it was obligatory upon the Council to purchase the Willesden Station of the Metropolitan Co., which was outside London. Under the clause he knew the L.C.C. had to pay to the companies, if they should acquire the City part of the Charing Cross Co.'s undertaking, sufficient to make up the interest on the capital to 4 per cent. per annum. That would mean, if the companies did not progress more favourably than at present, over half-a-million of money for that concern alone.

In answer to Mr. Blennerhassett (for the Westminster City Council), Witness said he knew that, with regard to the Westminster Co.'s Bill, there was an Instruction from the House that the L.C.C. was to be the purchasing authority, subject to the companies not offering any opposition to such legislative proposals.

Mr. Freeman then addressed the Committee on clauses which he had handed in. He said it was inconceivable that the L.C.C. should pay for severance which did not occur. He objected to the promoters stating what were to be "equitable terms." He suggested that the whole matter should be left to the arbitrator. He thought that the notice of ten years, which the companies wanted before their undertaking was going to be acquired, was too long.

After further discussion, the Committee decided to insert the clauses as proposed by the companies, with the alteration that the notice to be given by the L.C.C. should be three years.

The Chairman asked Mr. Browne whether, under the words "equitable terms," the arbitrator would not be entitled to award the companies compensation for goodwill or loss of profit. Mr. Browne said he thought that if the time of purchase of a company was anticipated, a company could claim compensation.

Mr. Hutchinson (for the promoters) said that they felt that no one could say at the present moment what would be the circumstances in 1931.

Mr. Freeman asked that the words of the 1888 Act should be inserted in the clause "having regard to all the circumstances of the case." The chairman pointed out that it was to the interests of the consumer that every facility should be given to the companies to develop their undertakings.

Replying to an observation by Mr. Freeman, the Chairman said that the Committee were unanimous that the companies should not get less than the terms of the 1888 Act.

The Committee rejected Mr. Freeman's amendment of the clause.

Mr. Hutchinson put in a clause to the effect that if the Charing Cross Co.'s undertaking was acquired in 1931, it should be under their City Order of 1899. At present the company was not purchaseable till 1941, when it then came under the general terms of the 1888 Act.

Mr. W. E. Fladgate, chairman of the Charing Cross, West End and City Electric Co., gave evidence in support of the clause.

Mr. Freeman objected to the proposal as all the circumstances would be taken into consideration by the arbitrator.

The clause was accepted by the Committee.

Mr. J. Conacher, manager of the Metropolitan Electric Supply Co., gave evidence in support of a clause providing that the L.C.C. should purchase the Willesden station of the company. He said that when it was put up it was mainly for lighting purposes, but when they lost Marylebone they obtained bulk supply powers. He did not think it would be a desirable thing that the L.C.C. should only take so much of the undertaking as was supplying London.

The Chairman said the Committee were desirous that the Council should not be put under the obligation to purchase the station which was outside London.

Mr. Blennerhassett, for Westminster City Council, said he wished to add a new sub clause at the end of the section transferring the local authorities' powers of purchase to the L.C.C. The clause would suspend, or it might modify, the decision of the Committee to transfer the powers of purchase, inasmuch as it would preserve Westminster rights.

The Committee said they could not alter their decision.

Wednesday, November 25th.

Mr. Munroe asked for a clause preserving the rights of Lambeth Borough Council. He said that the Borough Council were in a peculiar position, inasmuch as they had under the sanction of the Board of Trade leased their undertaking to a private company, with a proviso as to purchase. The Council could acquire the undertaking back either in 1918 or 1928.

Mr. Balfour Browne said he was willing to meet his learned friend to the extent that if the Council had not purchased the company's undertaking in 1928 then the L.C.C. should have the power to purchase in 1931. Mr. Freeman had said he would not interfere with Lambeth.

Mr. Freeman, for the L.C.C., said that although they had been authorised to acquire the companies' undertakings in 1931, they had not the power to carry on the undertaking afterwards. He suggested that the words, "that all powers now exercised by the local authorities shall cease, and be exercisable by the L.C.C.," be inserted. After a short discussion this was agreed upon.

Mr. Freeman asked that the powers in the clause requiring the L.C.C. to lend money to the companies during the latter years of their tenure should be optional. Mr. Balfour Browne opposed this, and asked that it should be obligatory.

The Committee decided that the powers should be compulsory.

Mr. Freeman put in a clause stating that when the time came for the L.C.C. to acquire the undertakings the purchase-money might, if agreed upon, be raised by the issue of stock.

Mr. Browne said that his companies had debenture-holders, and they would, of course, expect their shares to be redeemed in cash. He was willing to meet the L.C.C. by accepting half in stock.

Mr. Freeman said that under the National Telephone Co.'s agreement with the Government they accepted three-quarters in stock.

After further discussion the Committee fixed the amount to be paid in cash as to one-half of the purchase-money.

Mr. Freeman put in a new clause providing that the maximum prices for current for power purposes should be £6 15s. per kw. and 33d. per unit. Mr. Braithwaite had, he said, himself stated in evidence that the present maximum prices in the companies' Bills were nominal, and that he had no objection to their modification.

Mr. Balfour Browne opposed the proposal, and the matter was allowed to stand over until the L.C.C. and the companies had conferred together.

Mr. H. Lloyd, for the local authorities, suggested that the Board of Trade should fix the maximum price.

On the application of Mr. Freeman, the Committee decided that any proposals for linking up should be laid before the Board of Trade, and that the L.C.C. should be represented when such proposals were being considered by that body.

Mr. Lewis Coward asked that the L.C.C. should have power to express their opinion when the question of where the mains were to be laid by the companies was being considered.

The Committee refused to give the L.C.C. the power.

A proposal made by the L.C.C. that they should be constituted a "highway authority," was rejected. Several of the local authorities opposed the proposal on the ground that it would create a dual authority, as the roads were already under the control of the local authorities.

Mr. Freeman brought up a clause providing that when the L.C.C. acquired the undertakings in 1931, they should have powers to re-sell the distributing systems to local authorities.

The Chairman questioned whether the Committee had the power to give the L.C.C. the clause; whereupon Mr. Freeman withdrew it.

Other clauses having been adjusted, the Committee adjourned.

Thursday, November 26th.

Mr. Balfour Browne said that with regard to the maximum price which was to be fixed, his clients had had an interview with the L.C.C., and they had come to an agreement on the point.

In answer to a question by the Chairman, Counsel said that in some of the companies' Bills the maximum price was as high as 8d. per unit. As an instance of what his revised prices were, if a man had an eight hours' load, the price would be 1·03d. per unit. Continuing, Mr. Browne said the clause they proposed to insert provided that the maximum price per kw. should be £6 15s., and ·5d. per unit for energy for all purposes other than for lighting directly or indirectly. The demand was to be for not less than 2 kw. A sub-section provided that an agreement was to be entered into for the supply to be for a period of seven years. A further proviso stated that the demand was to be of such an amount that it gave the distributor a return of £20 per cent. per annum on the capital outlay, excluding costs of generating plant.

Mr. Freeman objected to this last proviso, and said that the first part of the clause covered the point.

Mr. Browne explained that a similar provision was inserted in the L.C.C. Bill of last year.

The Chairman: I think we will retain it.

Mr. Freeman brought up a clause providing that if the parties agreed, all of the purchase money could be paid in stock, and this was accepted. Another clause put in by the L.C.C., provided that in the event of a dispute arising as to the money to be advanced by the L.C.C. to the companies, it should be referred to the Treasury. Mr. Freeman explained that as Clause B now stood, the companies were to give six months' notice of their intention to borrow money of the L.C.C., and that within one month an answer should be given, stating on what grounds they objected to a loan in the event of their refusing to lend the money. The Board of Trade had also to determine whether or not such money was reasonably expended on capital account. Nothing, said counsel, was in the clause specifying that the L.C.C. were to be heard on the general question of whether any money should be advanced. He also asked that a longer notice should be given.

The Committee decided to allow the clause to stand part of the Bill.

An application by Mr. Freeman that the money advanced by the L.C.C. should be a first charge upon the companies' undertaking in priority to the debenture-holders, was rejected.

Mr. Vesey Knox, for the Southwark Borough Council, brought up a clause providing that if a supply was given to the London Electric Supply Corporation for distribution in the area in which Southwark Borough Council was giving a supply, the Council should also be able to get a supply on terms not less favourable, having regard to all the circumstances of the case. He said it would be a monstrous thing if all the companies were to combine and then compete with Southwark, and under those circumstances, he asked that he should be able to get a supply on equal terms.

Mr. Tyddlesley Jones, for the promoters, opposed the clause, and said that under the Equality Clauses of the 1882 Act, Southwark was protected.

The clause was rejected, as was also another one which sought to give Southwark the power to acquire from the L.C.C. so much of the electrical undertakings as was situated in the borough.

An agreed clause was put in the Bill protecting the rights of Lambeth Borough Council.

Mr. Courthorpe Munroe asked for a clause to be inserted for the protection of Woolwich Borough Council. He said that at present the Council had bulk supply powers outside their area, and he wanted a clause restraining the companies from going through his borough to supply a consumer just outside his area.

The Chairman remarked that the Bill was to extend the present undertaking, but Woolwich clause was restrictive.

Counsel: Only to the county of London.

After further argument, the clause was rejected.

London (Westminster and Kensington) Electric Supply Companies' Bill.

November 27th.

The Committee considered this Bill, Mr. Bushe appearing for the promoters.

In opening the case, Mr. Bushe said that the Bill was only a small one, but he thought it would be very useful. In their hands they hoped to make the scheme of great advantage to the public they served. The object of the Bill was simply to link up the four West-end companies—the St. James's and Pall Mall Co., the Westminster, the Kensington, and the Notting Hill Co. The principle of non-association amongst electrical companies had been in existence ever since the undertakings were started, but by the action of the Committee in passing the last Bill, he thought that the principle was now at an end. The fact of non-intercommunication had retarded the development of electrical undertakings, and was not conducive to economic working. The severity of the rule of isolation was relaxed, to a certain extent, in 1889, when Parliament allowed his four companies to split up into two groups—the Kensington and Westminster Companies joined together, and the Notting Hill and the St. James's had intercommunication. Each of those groups were supplied by a generating station, the first-named companies from a station at Marylebone, and the other from one at Wood Lane, at Hammersmith. The principle of that Bill would enable all of them to link up for mutual assistance.

Replying to the Chairman, Counsel said although their bulk supply stations were situated outside their areas of supply, they did not supply outside their districts.

Continuing, Mr. Bushe said that he understood there was no opposition to the Bill on preamble. Clause 5 of their measure dealt with the question of certain mains outside their area o

supply, but that was a matter for Westminster, as they were now the purchasing authority. Another clause carried out the instruction of the House to the Committee. They would remember that the Companies' Bill and his measure came before the House of Commons the same evening, and in the case of the first-named Bill an instruction was made that the L.C.C. were to be inserted as the ultimate purchasing authority. As regarded the measure now before the Committee, the Speaker informed the House that it would not be in order to insert a similar provision, as the notices published by the promoters did not mention anything about such a proposal. Accordingly, what they practically said was, "Whereas, inasmuch as we cannot arrange for the L.C.C. to be the purchasing authority, and as it must be dealt with in future legislation, we will take from you an undertaking that when such a proposal comes forward, you will not oppose it." They had drawn a clause to try and meet that view, with the exception that they should have the right, not of opposing the proposal, but of discussing the terms to be arranged.

Mr. J. L. Hordern, joint manager of the Central Supply Co., formally proved the preamble of the Bill, and the Bill was passed.

On clauses, Mr. Freeman, for the L.C.C., said that he wanted an addition to Clause 3, whereby, when any proposals were being made to the Board of Trade for the linking up of the companies, the Council should have the right of laying their views before the Board of Trade.

Mr. Bushe opposed the amendment.

Mr. Blennerhassett, for the Westminster City Council, said that, on behalf of the local authorities, he claimed that they should be allowed to make their representations to the Board of Trade when any proposals were being made.

After further argument, the Committee decided that, so long as the local authority remained the purchasing authority, they should be allowed to lay their views before the Board of Trade, and on the L.C.C. superseding the local authorities, then they should have the power.

An amendment to Sub-sec. 4, providing that the L.C.C. should have for all purposes under the said section, the same powers as the local authorities, was rejected.

The promoters put in a clause which stated that if within five years of the passing of the Bill, the Board of Trade or a Council of the Metropolis should promote a measure for the linking up of the undertakings for mutual assistance, the companies should not oppose such a Bill except to protect their interests.

Mr. Freeman asked for the elimination of "five years," and that after the words "Board of Trade," "the L.C.C. or any Council of the Metropolis" should be inserted. He said that the reason why he wanted the L.C.C. included was because very often other Councils asked them to promote a Bill. This was ultimately agreed to.

An amendment providing that the L.C.C. should be inserted as the purchasing authority under the terms of the 1882 Act, was resisted by Mr. Bushe, as he said it would be the greatest surprise and shock to the local authorities concerned if such an amendment were accepted. The Committee rejected it. A similar clause was inserted providing for a maximum price, as was done in the case of the Companies' Bill.

The Committee decided to insert a clause protecting the rights of the Metropolitan Water Board. The clause provided that if the promoters should lay a main within 6 ft. of the Board's pipes the company should give seven days' notice.

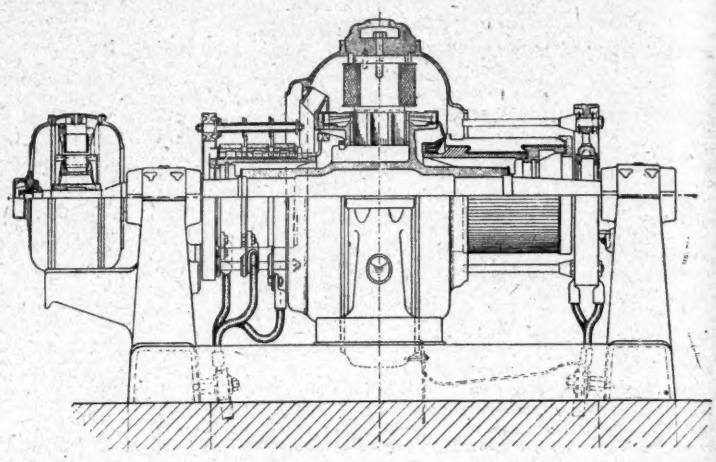
The Bill was then ordered to proceed as amended.

This concluded the consideration of the Electricity Bills, and the Committee rose.

Electrical Haulage in Alkali Mines.—A discussion on this subject has recently been carried on in "Glückauf," with the result that a wide divergence of opinion is shown to exist. Herr Scharf arrived at the conclusion that a steam plant would have to use 100 lb. of steam per horse-power-hour on the rope, averaged over the year, in order to cost as much as electric driving. Herr Philippi has now gone over the calculations, and points out a number of errors. In the first place, Herr Scharf based his assumption of the annual cost of lubrication, attendance and maintenance for an Ilgner fly-wheel converter, on the cost of a particular somewhat abnormal case, and so arrived at a figure some £150 too great. Again, the cost of the central station was inaccurately estimated, in that it was taken as varying in proportion to the power taken by the haulage plant instead of in proportion to the total power of which the haulage plant only uses a small fraction usually. Further, the boiler efficiency was taken as the same with steam and with electric haulage, whilst actually the greater uniformity of load with the latter leads to improved efficiency. There is also the reduced steam consumption for the other work of the mine, resulting from the fact that a larger and more efficient engine and dynamo central station plant can be installed if electric haulage is adopted. The sinking fund allowance was taken as 10 per cent. in both cases, thus assuming a life of less than nine years for both steam and electric plant, whilst actually the life of steam plant may be taken as some 15 years, and that of electric plant as 20 years. After making these various corrections, Herr Philippi comes to the conclusion that the steam haulage plant must show a consumption of not more than 35 lb. of steam per horse-power-hour on the rope, in order to compete with the electric plant.—*E.T.Z.*, November 5th, 1908.

A GERMAN ROTARY CONVERTER FOR 2,000 AMPERES.

Rotary converters are seldom used in Germany, chiefly because the commutation conditions on the direct-current side are sometimes unsatisfactory if the supply is at a normal frequency—such as 50. For lower frequencies—such as 25—they are quite satisfactory, but such frequencies are seldom met with. The Felten and Guilleaume-Lahmeyer Co. have recently supplied two 50-cycle rotary converters for electro-chemical work, of which the drawing given



2,000-Ampere Converter.

below shows the arrangement and dimensions to a scale of $\frac{1}{10}$ full size. The output of each is 200 kw. (110 volts and nearly 2,000 amperes). The speed is 750 r.p.m., and the voltage on the alternating side is 75 to 80, the supply being a three-phase one. Since starting up from the alternating side has its difficulties, and since, in this case, no direct-current supply for starting from the d.c. side is available, a separate 15-h.p. three-phase motor direct-coupled to the rotary is used for starting. This starting motor has six poles, so as to enable the synchronising speed of the eight-pole rotary to be easily reached.

The starting motor is supplied from a separate 220-volt transformer, which also does the lighting of the shops. The chief dimensions are as follows:—

Diameter of rotary armature	700 mm.
Breadth of iron	210 mm.
Diameter of commutator	450 mm.
Length of commutator collecting surface ...	400 mm.
No. of commutator plates	168
No. of brushes per spindle	6
Diameter of collecting rings	400 mm.
Breadth of each ring	100 mm.
No. of brushes per ring	18
No. of wires per slot	4
No. of armature coils	168
Field winding: turns per pole	546

The poles are solid, in order to ensure the necessary damping action without the use of special dampers. The brush portion is fixed and requires no adjustment even at the maximum load. The ventilation arrangements are such that a continuous draught passes over both the slip rings and the commutator surface.

The measured efficiency was 92·8 per cent. at full load and 89·9 per cent. at half-load—the specified figures being 91 per cent. and 86 per cent.—*E.T.Z.*, March 19th, 1908.

Physical Society Exhibition.—At the exhibition to be held by the Physical Society on Friday evening, December 11th (from 7 p.m. to 10 p.m.) at the Royal College of Science, South Kensington, the following firms will be exhibiting:—Messrs. Cambridge Scientific Instrument Co.; Casella & Co.; A. C. Cossor, Ltd.; J. H. Dallmeyer, Ltd.; Elliott Bros.; Everett, Edgcumbe & Co.; Gallenkamp & Co., Ltd.; Gambrell Bros.; J. J. Griffin & Son; A. Hilger, Ltd.; India-Rubber, Gutta-Percha & Telegraph Works Co.; Marconi's Wireless Telegraph Co.; Nalder Bros. & Thompson; Newton & Co.; R. W. Paul; James Pitkin & Co.; Siemens Bros. and Co.; Snell & Tinsley; J. Swift & Son; Alexander Wright and Co.; and Carl Zeiss, Ltd. From the programme, of which we have received an advance proof, there appear to be many items of considerable interest to both physicists and electrical engineers. We understand that invitations have been given to the Institution of Electrical Engineers, the Faraday Society, the Optical Society, and the Röntgen Society. Admission, however, except to Fellows of the Physical Society, will be by ticket only, and therefore members of the societies just mentioned desiring to attend the exhibition should apply to the secretary of the society to which they belong.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ADEN.—No import duties on electrical or similar materials.

ANTIGUA.—The following are free:—Oil-fuel for oil engines; railway and tramway rolling stock and materials for permanent way; steam engines, steam pipes, boilers, boiler tubes; machinery, stationary or portable for agriculture, irrigation, mining, cotton ginning or baling; also for the manufacture of rum, sugar, or cotton seed oil, and necessary parts for communication of power thereto, when not imported for sale.

All other electrical and similar goods, *ad valorem* ... 13½ %

The value on which duty is levied is the invoice value of the goods at the place from which they were shipped, not including the value of packages and wrappers other than butts, puncheons, hogsheads, tierces and trunks.

N.B.—The importation or establishment of any apparatus or installation for wireless telegraphy is prohibited without a licence from the Governor.

ARGENTINE REPUBLIC.—The duties on imported goods are payable in percentage of valuations fixed by the Custom House. The duty leviable on goods not included in the tariff of values, is calculated on the value declared by the shippers and substantiated by means of the original invoice. The exact net and gross weights in kg. should be marked on each package and specified on invoices, bills of lading and certificates of origin. If different classes of goods are included in one package, the net weight of each class should be stated. The origin of the goods should be declared on all documents. Packages should be marked and numbered on both sides and not on the top, and the gross weight in kg. should be stated. Bills of lading and one certificate of origin in English or Spanish must be presented for visa at the Argentine Consulate in the place of origin. Bills of lading may be obtained at the Consulate at a cost of 8s. per set of three stamped copies. No charge is made for legalising the certificate, forms of which may be obtained at the Consulate. Duties are payable at the gold rate of exchange (gold peso = 4s.); one kg. = 2·204 lb.

The duty is 27% on the undermentioned values, except where shown otherwise in brackets:—

	Pesos.
Electrical accessories of all kinds, such as switches or fusible wires, interceptors, interruptors or alarm keys, buttons, commutators of all shapes and systems, with base and cover of porcelain or wood, per kg.	·55
Ditto, base of porcelain and cover of metal, papier maché or wood, per kg.	·80
Ditto, base of slate or marble, with or without cover, per kg.	1·20
Ditto, in the form of spare parts of bronze or copper, without their bases of porcelain, slate or marble, per kg.	2·50
Bronze claws, sockets and connections, per kg. ...	1·80
Insulators of glass, per kg. (gross)	·06
Insulators, of earthenware, faience or porcelain, of more than 3 cm. dia., with or without hooks, per kg. (gross)	·12
Ditto, up to 3 cm. diameter, per kg. (gross)	·25
Wire or cables of copper, up to 5 mm. diameter covered with cotton, gutta-percha or other material, with the exception of those covered with lead or silk, and all kinds of flexible cord, per kg.	·70
Ditto, of more than 5 mm. diameter per kg. ... (5 %)	·60
Ditto, covered with lead, up to 5 mm. diameter, per kg.	·50
Ditto, covered with lead, of more than 5 mm. diameter per kg. ... ... (5 %)	·70
Ditto, of all diameters, covered with silk, per kg. ...	2·50
Ditto, of lead, of whatever number, per kg.	·15
Ditto, strengthened, underground, with interior cover of lead and iron or steel armour, per kg. ... (5 %)	·25
Ditto, of iron or steel, covered with cotton, gutta-percha or other materials, per kg.	·30
Ditto, flexible cords, of two or more conductors, of copper, twisted, of whatever diameter, covered with cotton, mohair, wool or other materials, with the exception of silk, per kg.	1·50
Ditto, covered with silk, per kg....	2·50
Amperemeters or voltmeters, pocket, each	2
Ditto, other, each	5
Morse telegraph apparatus, each	18
Ditto, without clockwork, each	9
Sheaths or tubes of porcelain, per kg.	·12
Bell pushes of wood, ordinary shape, per doz.... ...	·40
Ditto, pear shaped and other kinds, including those of porcelain, per doz.	·80
Electric bells, each	·50
Carbons for arc lamps per kg. (gross) ... ...(37 %)	·20
Carbon retorts for charging the porous cells for batteries and for other purposes, per kg. (gross)	·08
Carbon electrodes for furnaces, per kg....	·10
Brushes of metal, anti-friction, for dynamos and electric motors, per kg.	·60
Brushes of graphite or carbon for dynamos and electric motors, per kg.	·20

(To be continued.)

VENTILATED TRAMWAY MOTORS.

By J. C. STEWART.

In his inaugural address to the Leeds Local Section of the I.E.E., Mr. H. E. Yerbury referred to the question of ventilated motors for tramways.

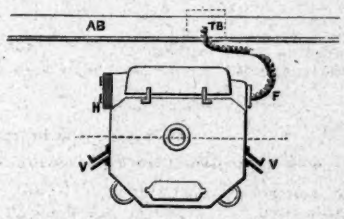
Some months ago the writer, in endeavouring to get a more weather-proof arrangement, or rather, one that would withstand the weather for a longer time without renewal, accidentally created an exhaust ventilator.

From the junction box cabling taps to the motor taps it is usual either to use a special multi-core cable, or to enclose the cabling in stout hosing. On account of this hosing having to stand very trying weather in this climate, the renewals of both hose and cabling are a considerable item in upkeep, not to mention increased inspection and testing.

The weakest and most fruitful cause of trouble was found to be just where the cabling passes through the motor casing and bends round to the brush carriers.

The limited space between the cross bar suspension and hole for the cables creates loopholes for inferior treatment, and consequent troubles, due to moisture finding its way into cabling and motors.

To get rid of the trouble, two lengths of flexible steel hosing, 2 in. in diameter, flanged at one end, were bolted to the motor shells with a joint ring between shell and flange, as shown in the sketch. The other end of the hose was then



A D, Air duct running full length of seat, with outlets on to car platforms; H, Old inlet for cables behind suspension bar; F, Flanged flexible steel hose; T B, Terminal or junction box; V V, Position of proposed inlets.

View showing Arrangement of Steel Hosing for Tramway Motor.

brought through the car flooring to the side of the junction box and fixed with a suitable cleat. From the junction box the cables were passed through the tube to the brush rockers and fields, giving a straight run along the back of the brush carrier to the terminals. The old apertures were plugged up, as were also the cross-connector holes between the top and bottom field coils, after finding a more suitable method of fixing the latter inside the shell.

This arrangement has been working for five months, and repeated inspection shows that the steel flexible and cables are in the same condition as when put in—and no moisture has been found to penetrate to either leads or motor.

When testing motor temperatures lately, it was discovered that the motors equipped as above ran cooler than any of the others working under the same conditions, and this was found to be due to the escape of hot air up the flexible steel tube and through the longitudinal lath and space seat. To prevent discomfort to passengers and to carry this hot air away from the motors, a rectangular trough can be fixed bottom up to the flooring under the seat, and outlets provided at either end, or a false floor fitted under seats.

Alternatively a special outlet can be made through the rocker panel on the top of the side-sills.

Further, by arranging a weather, and as far as possible dust, proof inlet on the motor shell, it is possible to get forced air-blast through the motors.

The writer intends to carry out a few simple experiments with the object of designing such a weather and dust proof inlet, and would be glad to have the opinions of some of the readers of the Electrical Review through its columns.

British Made Only.—Islington B.C. last Friday resolved that the various Committees be instructed to give preference, where reasonably practicable, to goods of British manufacture.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

24,581. "Improved means for regulating polyphase electric commutator machines." ALLMANNA SVENSKA ELEKTRISKA AKTIE-BOLAGET. (Date applied for under Sec. 91 of the Act, November 19th, 1907, being date of application in Sweden.) November 14th. (Complete.)

24,583. "Improvements in secondary electric clocks." T. J. MURDAY. (Date applied for under Rule 13, October 27th, 1908; an invention comprised in Application No. 22,819, dated October 27th, 1908.) November 16th.

24,594. "Improvements in the electrolysis of liquids." J. BILLITER. November 16th. (Complete).

24,597. "Process for producing transparent flexible infusible insulating media." K. WINKLER. (Date applied for under Sec. 91 of the Act, November 19th, 1907, being date of application in Germany.) November 16th. (Complete.)

24,618. "Improvements in or relating to electric automatic call boards for controlling time signals and apparatus connected therewith." J. APPLEBY and A. E. DREW. November 16th.

24,634. "Improvements in regulators for dynamo-electric machines." DICK, KERR & Co. LTD. (Thury, Switzerland.) November 16th.

24,643. "Improvements in arranging for the charging and discharging of accumulators." A. M. TAYLOR. November 17th.

24,654. "Hand-driven electro-magnetic machine." S. OLIVA and S, CONSIGLIERE. November 17th.

24,688. "Electric wind discharge device for collecting, separating or dispelling all kinds of dust, hairs, fabrics, all solid matter, fumes, and the like from air or other gases." S. GROOM. November 17th.

24,701. "Improvements in and relating to overhead electric conductors." F. E. SAUNDERS. November 17th.

24,702. "Improvements in and relating to electric cut-outs." T. E. MURRAY. November 17th. (Complete.)

24,711. "Improvements in electric ignition devices for internal combustion engines." T. E. B. BROWN and J. A. ROSS. November 17th. (Complete.)

24,737. "Improvements relating to magneto ignition apparatus." SOCIETE ANONYME MONTARBON. (Date applied for under Sec. 91 of the Act, December 19th, 1907, being date of application in Belgium.) November 17th. (Complete.)

24,759. "Improvements in and relating to electric ignition devices, particularly for internal combustion engines." L. H. HOUNSFIELD. November 18th.

24,760. "Improvements in regulating arc lanterns for theatres or the like." H. POWELL. November 18th.

24,765. "Current distributor and timer for magneto-electric generator." H. F. JOHNSON and A. LUTZ. November 18th.

24,766. "Brake for electric trams and the like, to be used only in case of emergency." T. JONES and L. J. EVANS. November 18th.

24,767. "Improvements in secondary batteries." A. M. TAYLOR. November 18th.

24,785. "Improvements relating to ignition apparatus for explosion engines." C. SCHMIDT. (Date applied for under Sec. 91 of the Act, November 18th, 1907, being date of application in United States.) November 18th. (Complete.)

24,794. "Arrangement in continuous-current motors to regulate the number of revolutions and the starting moment." P. SCHARF. November 18th.

24,815. "Electrical instrument for pyrogravure and surgical purposes." P. BERVILLE. November 18th. (Complete.)

24,854. "Improvements in and relating to dynamo-electric machines." BRITISH THOMSON-HOUSTON Co., LTD., and F. P. WHITAKER. November 18th.

24,909. "Electro-magnetic transmission of power especially applicable to motor vehicles." J. LECOCHE. November 19th.

24,918. "Improved electric switch for controlling ignition internal combustion engines." C. WILLEBY. November 19th.

24,951. "Sand gear for electric tramcars, motor omnibuses, wagons and the like." E. E. KENWORTHY. November 20th.

24,972. "Telephone improvements." H. W. SULLIVAN. November 20th.

24,977. "Improvements in electric incandescent lamp fittings and the like." W. WARDLE, jun., and A. TAYLOR. November 20th.

25,029. "Improvements in and relating to wireless telegraph systems or the like." S. EISENSTEIN. (Application for Patent of Addition to No. 20,128/07.) November 20th. (Complete.)

25,044. "Improved metal filament electric glow lamp." H. KUZEL. (Date applied for under Sec. 91 of the Act, May 14th, 1908, being date of application in Germany.) November 20th. (Complete.)

25,122. "Improvements in or relating to telephone apparatus." T. E. WINTERBOTTOM. November 21st.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. THOMPSON & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1907.

ALTERNATING-CURRENT COMMUTATING ELECTRIC MACHINES. Allgemeine Elektricitäts Ges. 23,448. October 23rd. (Date applied for under International Convention, October 24th, 1906.)

METHOD OF RENEWING THE CARBON RODS IN ARC LAMPS HAVING ELECTRODES SUPPORTED FROM BELOW. Deutsche Beck Bogenlampen Ges. 23,781. October 28th. (Date applied for under International Convention, October 26th, 1906.)

ELECTROLIERS AND CEILING ROSES THEREFOR. G. F. Woods. 23,950. November 30th.

ELECTRICAL CONTACT BREAKERS FOR USE ON INTERNAL-COMBUSTION ENGINES. S. S. Guy and G. A. A. Bennett. 23,957. October 30th.

BAYONET JOINT FOR PARTS WHICH ARE REQUIRED TO BE DETACHABLY CONNECTED TOGETHER, ESPECIALLY APPLICABLE TO ELECTRIC INCANDESCENT LAMPS AND HOLDERS THEREFOR. H. E. Theobald. 23,991. October 30th.

ELECTRIC MOTOR CONTROLLING APPARATUS. E. Chaudoir. 24,002. October 30th.

PROCESSES OF MELTING IN ELECTRIC FURNACES AND THEIR APPLICATION TO THE EXTRACTION OF EASILY VOLATILISABLE METALS. H. Herrenschmidt. 24,517. November 5th. (Date applied for under International Convention, November 8th, 1906.)

CONTROL OF ELECTRIC MOTORS. A. K. Baylor. 24,879. November 9th.

ELECTRIC TELEGRAPHY. S. G. Brown. 25,286. November 14th.

ELECTRO-DEPOSITING APPARATUS. W. Hartnell. 25,324. November 15th.

TELEPHONE RECEIVERS. K. E. Ericsson. 25,570. November 23rd.

ENCLOSED ARC ELECTRIC LAMPS. G. W. Farthing and T. K. Steanes. 26,135. November 26th.

ALLOYS USEFUL AS ELECTRIC RESISTANCE CONDUCTORS. British Thomson-Co. (General Electric Co., United States.) 26,940. December 5th. (Cognate Application 12,183 of 1908.)

ELECTRIC TRANSFORMERS. L. Maiche. 27,157. December 9th.

ELECTRICAL BRUSHES OR COLLECTORS. R. H. Barbour. 28,482. December 27th.

PROCESS FOR THE PRODUCTION OF A SUBSTANCE FROM ALBUMENOIDS, PARTICULARLY APPLICABLE FOR USE WITH SECONDARY BATTERIES. E. C. Ekstromer and H. Ekstromer. 28,619. December 30th.

INDUCTION GENERATORS. J. L. Milton. 17,635. August 1st.

METALLISATION OF VITREOUS, PORCELAIN, EARTHENWARE AND THE LIKE SURFACES SO THAT METAL OR METALLIC ALLOY MAY BE ELECTROLYTICALLY DEPOSITED UPON SUCH SURFACES. Q. Marino. 17,743. August 3rd.

SINGLE-PHASE ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES. M. C. A. Latour. 23,916. October 30th. (Date applied for under International Convention, October 31st, 1906.)

ELECTRIC TELEGRAPH APPARATUS. S. G. Brown and A. L. Dearlove. 23,977. October 30th.

PROCESS FOR PRODUCING TUNGSTEN METAL COMBINATIONS. W. Harrison and C. H. Dorman. 23,988. October 30th.

ELECTRO-MAGNETIC RELAYS. British Thomson-Houston Co. (General Electric Co., United States.) 24,006. October 30th.

MAGNETO AND DYNAMO-ELECTRIC GENERATORS. F. T. Reid. 24,234. November 1st.

ELECTRIC SIGNAL LAMPS. C. W. Cox and Edison & Swan United Electric Light Co. 24,343. November 4th.

ELECTRIC RADIATORS AND OTHER APPARATUS WHERE BANKS OF MASSED LAMPS OR OTHER RADIATING DEVICES ARE USED. W. Fennell and W. P. Perry. 24,550. November 6th.

DEVICES FOR INDICATING THE EXTENT OF THE CHARGE OR DISCHARGE OF AN ACCUMULATOR OR STORAGE BATTERY. A. A. K. Gese. 24,933. November 11th.

DISTRIBUTION OF ELECTRIC POWER BY ELECTRIC TRANSFORMERS. J. T. Irwin, W. E. Robson and J. L. Cook. 25,842. November 22nd.

1908.

APPARATUS FOR THE PRODUCTION OF UNDAMPED ELECTRICAL VIBRATIONS. S. Eisenstein. 72. January 1st.

DYNAMO-ELECTRIC MACHINES. E. F. W. Alexanderson. 661. January 10th. (Date applied for under International Convention, January 12th, 1907.)

VIBRATION GALVANOMETERS. W. Du B. Duddell. 1,779. January 27th.

INCANDESCENT ELECTRIC LAMPS. J. A. Leon. 3,076. February 11th.

MANUFACTURE OF FILAMENTS FOR ILLUMINATING AND HEATING PURPOSES. G. Michaud and E. Delasson. 8,104. April 11th. (Application for Patent of Addition to No. 4,461 of 1908.)

INCANDESCENT FILAMENTS FOR ELECTRIC INCANDESCENT LAMPS. Wolfram Lampen Akt.-Ges. 8,416. April 15th. (Date applied for under International Convention, April 26th, 1907.)

ELECTRIC CONTACT-MAKERS, DISTRIBUTORS AND THE LIKE. A. G. Benstead. 8,481. April 16th.

ELECTRIC KETTLES, URNS, WATER OR OTHER LIQUID HEATING AND BOILING APPARATUS AND THE LIKE. J. E. Pownall. 8,679. April 21st.

ELECTRICITY METERS. E. Evans. 9,675. May 4th.

VARIABLE SPEED GEAR FOR ELECTRIC AUTOMOBILES. C. M. De Sainte-Claire. 9,789. May 5th. (Date applied for under International Convention, August 17th, 1907.)

STORAGE BATTERY PLATES. A. O. Tate. 10,769. May 18th. (Date applied for under Rule 13, December 20th, 1907.)

ELECTRICAL DISTRIBUTION. J. L. Woodbridge. 12,825. June 6th. (Date applied for under International Convention, October 2nd, 1907.)

ELECTRIC SWITCHES. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. 13,025. June 18th.

CURRENT COLLECTORS FOR ELECTRICAL MACHINES. Akt.-Ges. Brown, Boveri and Cie. 14,763. July 11th. (Date applied for under International Convention, November 9th, 1907.)

CONTROL OF TRAFFIC ON ELECTRIC RAILWAYS. W. R. Sykes and C. J. Cooke. 15,590. July 22nd.

DIRECT-CURRENT ELECTRIC MOTORS. Soc. Anon. Westinghouse and R. Brun. 16,986. August 12th. (Date applied for under International Convention, August 14th, 1907.)

TELEGRAPH KEYS. J. Z. Tucker L. V. Tucker, F. J. Hudson, B. J. Cissell, E. J. Cissell and N. J. Rankin. 18,457. September 2nd.

TELEGRAPHONE APPARATUS. A. E. Hytten. 425. January 7th.

APPARATUS FOR STRAINING TELEGRAPH, TELEPHONE AND LIKE WIRES. R. B. Ransford. (W. A. Manson, Natal.) 980. January 15th.

NUT FOR THE TERMINALS OF ELECTRIC ACCUMULATORS. E. A. Tunbridge. 2,294. February 1st.

MEANS FOR TURNING ON AND OFF GAS OR ELECTRIC LAMPS FROM A DISTANCE. J. V. Wengelin. 2,492. February 4th.

ELECTRIC CONNECTIONS. H. D. B. How and W. W. Partington. 3,049. February 11th. (Post-dated April 4th, 1908.)

VARIABLE-SPEED DYNAMOS. H. Leitner. 3,391. February 14th.

ELECTRICAL APPARATUS FOR THE PRODUCTION OF SOUND IN AIR OR WATER. W. D. Kilroy, J. C. Needham and Eversheds & Vignoles, Ltd. 3,663. February 18th.

METHOD OF HOLDING OR CLUTCHING GAS OR ELECTRIC GLOBES OR SHADES IN THEIR GALLERIES. A. Morrison. 6,605. March 25th.

IGNITION APPARATUS FOR EXPLOSION ENGINES. H. C. Royer. 6,939. March 28th.

HAND-FED ARC LAMPS. J. Bonn and A. E. Jones. 9,620. May 4th.

FILAMENT FOR ELECTRIC GLOW LAMPS. J. W. Ward and R. H. Stevens. 10,093. May 9th.

MEANS FOR ELECTRICALLY OPERATING TRAMWAY POINTS FROM THE VEHICLES. A. Kohler and F. Kohler. 11,175. May 22nd.

SURFACE CONTACT ELECTRIC TRACTION SYSTEMS. E. A. Mitchell. 11,945. June 2nd.

ALTERNATING-CURRENT MOTORS OF THE COMMUTATOR TYPE. British Thomson-Houston Co. (General Electric Co., United States.) 12,580. June 11th.

INCANDESCENT GAS LAMPS PROVIDED WITH ELECTRIC IGNITION. M. Delage and P. Woog. 13,852. June 30th. (Date applied for under International Convention, December 31st, 1907.)

Electric Cranes for House-Breaking.—The recent application of electric cranes to house-wrecking operations, in connection with the Chicago City Hall, supplies another interesting illustration of the constantly widening use of electric power, and of the ruggedness of the operating machinery. House wrecking is rough work. It involves dust and dirt in profusion, and more or less careless handling of the machinery employed in it, and the fact that the electric outfit which is used withstands all this is renewed good evidence that it is not only fool-proof, but proof also against highly unfavourable conditions of wear.—*Electrical Record*, New York.